COLOUR PSYCHOLOGY

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BOMBAY
NEW BOOK COMPANY
188-90, Hornby Road,
1944

First Published March, 1944.

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Printed by A. F. de Sousa at the Fort Printing Press, No. 23, Goa Street, Ballard Estate, Bombay, and Published by P. F. Dinshaw for The New Book Company, 188-90, Hornby Road, Bombay.

Inscribed to

Mr. Sohrabshah Jamshedji Bulsara

My dear Mr. Sohrabshah,

It gives me great pleasure and satisfaction to inscribe my "Colour Psychology" to you. All over the world there are millions of teachers, tutors, lecturers and professors, and nearly all get paid for the teaching they give. You are one of those exceedingly few who have done this as a labour of love and perhaps also for the love of the pupil. When I was in my early teens you were a full-fledged Master of Arts, yet like the truly great it did not worry you to spend your valuable time in solving my various difficulties, were they in physics, philosophy, psychology or abstruse problems of metaphysics, reincarnation or religious controversies. Even when I argued with you on subjects you knew so well while I had only started to read them as subjects in no way connected with my school studies, and in which naturally I had difficulties, you were always patient and indulgent.

I know how you spent three or four evenings every week for years solving my difficulties without the remotest thought of any kind of recompense. Not only did you take all this trouble without any thought of return, but you taught me much with fondness that looked almost like love. So my dear Mr. Sohrabshah when I inscribe this book to you I clear my conscience as I have never done anything for you in return for what you have done for me in laying the foundations of clear thinking and in encouraging me to read subjects and books much above the standard of high-school boys. All these years what I have admired the most has been that you never lost your temper and never told me that I should not argue with you.

Finally I thank you for all that I have learnt from you and inscribe this book as a token of my gratefulness.

Yours sincerely,

PESHOTON S. DUBASH.

Karchi, 21st March, 1944.

INTRODUCTION

Having been always interested in colours, as I spontaneously took to painting from my early childhood, colours were not mere superficialities but realisable actualities to me. However, now and again I came across people who either looked down upon colour predilection as a remnant of primitiveness or altogether a fanciful fad of a slightly deranged mind. While on the other hand I found some who looked upon colours as the mysterious key of either appreciating the wonderful or of explaining all the problems. This made me think it very desirable to investigate the possibilities of colours by both practical experimentation and study.

The slight study of it at once enchanted me into the realm of colour-healing. So I asked a medical friend of mine about it, and he told me that he did not believe in it and very much wished that nothing good about it should ever be proved. There are many such medical men who will simply ridicule chromopathy without investigation. On the other side, there are some extremists who ridicule drugs. Yet when one considers the fact that an average medical man has to go through at the least three years' good study when he learns the value of drugs and also knows the physiology of the body on which they are used, it is evident that he is not willing to swallow new notions that look more or less magical. No conscientious medical man can adopt all novelties brought before him in preference to well established facts. However, it is at times questioned whether the effects of drugs are well-established and if sometimes the answer is in the negative one must remember that the efficacy of other means are

chapters treats fully of my experiments and the deductions, but here I must offer my heartfelt thanks to Mr. H. Stainsby of the "National Institute for the Blind," Mr. J. M. Ritchie, of the "London Society for Teaching and Training the Blind," at Swiss Cottage the Manager of the "British Association for the Welfare of the Blind" and to the Rev. St. Clair Hill, M.A., of the "Leatherhead Royal School for the Blind." The first two offered me three separate opportunities.

To me the yellow colour used to be as objectionable as red is to the bull. On the other hand violet is as welcome as music, in fact, in a room adorned in all violet I can sit for hours in a state of great happiness. This became very striking once when I went to more or less a lady's tea room in a flower-shop in Glasgow after a whole day's work at engineering and enjoyed that noiseless music of colours with a preponderance of violet and purple, a little varied by green. This made me decide to investigate into the psychological effects of colours to find out something definite. I wrote to several London hospitals requesting permission to visit the patients and find out how colours affected them. I preferred to write to the hospitals treating cases suffering from nerves. It was difficult to get the permission in most cases, but I succeeded in getting the permission to investigate in the "Maida Vale Hospital for Epilepsy and Paralysis," the "British Hospital for Nervous Disorder" and the "Metropolitan Hospital." For the first I must thank Mr. Burleigh and the house physician; for the second the manager and for the third my friend Dr. R. N. Cooper, who was one of the house physicians. The results that I arrived at will be mentioned in the book, but here I may add that the results are very definite.

I had previously written a short report on "Colour-Preference in Children" from the returns of the Experimenters' Circle, but I wished to authenticate them by a little larger number and so I persuaded several teachers in London County Council and other schools to get me some statistics.

It struck me that the colour-preference may vary with the age and to decide this point I undertook a little more searching investigation and got a few thousand question forms printed and circulated them in different quarters. They were circulated for me by the Registrar of the University of Durham, the Principal of the Northampton Engineering Day College (London University), the Principal of the International College of Chromatics, the Secretary of the National Association of Art Masters, Mr. Hunter of the National Bank of India, the Secretary of the Forest Hill and District Literary Society, the Chairman of the Mildmay and New Era Circle, and the Secretary of the Ceylon Students Society, and Mr. Fred Tallant, the Hon. Secretary of the C.H.A. London Rambling Club. With regard to the last splendid institution I must add that as far as cultivating taste by arts indoors and appreciation of nature outdoors is concerned, it does as good work as many colleges. Of this last Club I must mention the names of the following lady teachers who helped me in getting some statistics: Miss E. M. Gould, Miss Nettleton, Miss Armstrong, Miss E. Luckins, Miss A. Owen, Miss Houston and Miss G. Green. With all these ladies and gentlemen I must also thank Miss Leysham and Miss L. Derbyshire.

Though other societies, colleges, etc., also were sent such forms (some did not answer whether they did anything with them and others returned them blank) yet the returns of just a few hundreds were not sufficient and so I appealed to Mr. Ernest

Clark of Clark's College, who passed my letter to Mr. Cunningham Cole, the business manager. Mr. Cole not only very readily came to my assistance by agreeing to get the needed statistics, but even went to the trouble of getting one thousand more forms made in the College and sent them round to different branches and got returns which substantially augmented my statistics. This will show that Clark's Colleges are not merely a money-making concern, or only a self-helped university of commercial and civil service education, but even a national asset encouraging research. My heartfelt thanks are due to the business manager, Mr. Cole, and the principal, Mr. Ernest Clark.

I have seen articles written from statistics of seven, seventeen, fifty, and books from those of a hundred or five hundred, so I believe I shall be forgiven for writing this book of statistics of over three thousand people. However, I have realised that this number is not so large as to be altogether reliable, and so, I have supplemented it with a very prolonged and careful study and have made every effort to authenticate my own deductions by producing evidence from different quarters based on my own observations and the investigations of others. Yet, when I have found it desirable to disagree on some points, I have honestly done so.

It always seems to me that if any fundamental law is found it has some bearing in most aspects on the phenomena of nature. For example, the law of the preference of the path of least resistance exists in the majority of nature's features, the same as my law of specialization philosophically propounded in my thesis, "Continuity—from Electrons to Infinity." On this account to prove my notions about colours I have brought in evidence from various view points. Yet one must not forget the most important

of all—the human element. Though I have not lived in all the parts of the world, yet being a true internationalist and inter-religionist, I have mixed freely with a very great variety of nations and races, and I have even lived for years in both the east and the west and travelled over a few hundred places in England, Scotland, Ireland, Germany, Holland, Denmark, Norway, Sweden, Finland, Estonia, Belgium, France, Switzerland, Italy, Latvia, Spain, Poland, Turkey, Hungary, Austria, Roumania, Albania, Greece, Yugoslavia, Egypt, U.S.A., Burma, Sindh, Punjab, Central Provinces of India, Bombay Presidency, Gujarat, Bengal, and Deccan Hyderabad, and so I may be allowed to make reflections on different races that I have come across and observed. My point of view is to be fearlessly truthful which is the only right way (in my opinion) of writing a book that may be scientific and yet for the general public also. If I have said something that reflects adversely on any race, it may be taken that I believe it and not because I wish to hurt anybody. However, if I do so I wish to crave their forgiveness.

Finally, though my investigations and discovery of the blind differentiating between colours by their ears was made in 1918, I have continued to study and observe and now after twenty-five years' conviction that colours are not mere ocular superficialities but effectual realities I put this book before the world.

I thank Miss Kate Augusta Stevens for revising and correcting the typescript.

In investigating the phenomena of after-image I sacrificed some power of my eye-sight, but I hope these findings are interesting and will be useful some day.

PESHOTON SORABJI DUBASH

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COLOUR PSYCHOLOGY

CHAPTER I

PHYSIOLOGICAL PHENOMENA

The realm of physics is distinct from the realm of psychology. In nature very hard and fast divisions do not come about abruptly and as a rule there is a continuity between different realms. The realm of physiology connects the realms of physics and psychology. In doing so it overlaps them both. Where it overlaps the psychological realms we get the field of psycho-physiology. Psycho-physiology embraces the study of the phenomena of senses. Of these the phenomena of sight are of interest to us here especially. Sight seems to be the most psychic of all the senses: touch, smell, taste, hearing and sight. Visual phenomena may be classified into the perception of:

The Psycho-Physiological Realm

(1) Light and darkness, (shades intermediary);
(2) Form—contour and size;
(3) Colours—subjective and objective divided into pigmentary, luminous, physiological and psychic.

In this book we are concerned mostly with colours. It is now almost universally acknowledged that human beings from prehistoric days have had a clear sense of colour, and that Gladstone and other theorists who worked up entertaining contributions to colour literature on philological suppositions that colour sense is a newly evolved sense, are wrong. Grant Allen

says, "Geiger, Magnus and Mr. Gladstone seem to have sat down in their libraries, consulting frail linguistic authority of the Vedas, the Homeric poems and the Hebrew prophets, but never to have tested the truth of the philological conclusion by reference to museums and art collections or even to the works of antiquarians and explorers." Remarks on the evolution of colour sense will be made later on, but now we are concerned with colour vision. The description of the construction of the eye is so often repeated in books and can so easily be referred to in any illustrated encyclopaedia that I exempt myself from doing the same here without any hesitation. Equally monotonous is the repetition of the spectroscopic analysis of white light and other inter-related matters. Though many books have mentioned the different theories of vision very few, if any, have mentioned all. It is difficult to mention all because some may be hidden in corners of the world not accessible to most people, and new ones are constantly being brought out. However, an attempt is made to recapitulate them as exhaustively as possible.

Theories of Colour Vision

From the wonderful coloured enamelled tiles of the ancient Zoroastrian Persians, the variegated colours of the ancient Egyptian buildings, the beautiful colour schemes of the ancient cultured Hindus, the admirable works of arts of the ancient Chinese, and from the interesting notions of the pre-Mohamedan Arab physicians, one feels sure that these people were keenly appreciative of colours, and therefore one is not surprised that even in those days of ancient civilization and of ancient Hindu culture searching minds were led to make all sorts of hypotheses about colour vision in the East, just as much as Alemaenon, Empedocles, Aristotle, Democritus, Anaxagoras, Plato, and Diogenes, in the West. Though we

respect all these men, yet as their theories were more speculative and less based on vast observation and experimentation than those of modern days, we forthwith start on the latter. Amongst the first notable theories is that of Young, which was better expounded and correlated by Helmholtz, and now-a-days is known as the Young-Helmholtz theory. This takes for granted three colours, red green and violet, and three kinds of nerve-elements corresponding to these as primary colours. This idea had its day, but now-a-days it is not accepted. All who propounded any theory of their own have found faults with it and most other writers and investigators have done the same. Herring suggested that the perceptions of white, red and yellow were the sensations of dissimilation, and black, green and blue those of re-assimilation of the visual substance which underwent decomposition and restitution by the action of different kinds of lights. Preyer put forward the idea that the sensation of colour was developed by the effect of temperature through a very acute sensitiveness restricted to the retina. He suggested that the intensity of brightness depended upon the degree of the excitation, and the quality upon the frequency of the vibration. Hence the spectrum disintegrated itself into a series of warm and cold colours. According to him, "Every optic nerve-fibre ends in two cones, one of which is excited by warm-coloured and the other only by cold coloured light rays. The excitations are received by the ganglion cell which transmits to the brain either the former or the latter, never both together. In normal eyes the cones are present in equal proportion and are so arranged that the warm cones, sensitive to red and yellow, are at equal distance from each other and from the cold cones, sensitive to green and blue." This theory has obtained much favour in the eyes of opthalmologists. However, it has the defect of restricting the colour percep-

tion to the eyes only. The fallacy of this will be seen in later chapters. Prof. Ebbinghaus's theory is that what is known as visual purple, first turning yellow and then white on exposure to light, is the same as a photo-chemical substance of such a nature that its primary partial dissociation is the cause of the sensation of yellow, and its secondary completed dissociation is the cause of the sensation of blue. He believes that cones contain no visual purple; a second visual substance conceals this purple and that this substance becomes green, red and white, giving the corresponding colour sensations, and that both cones and rods have yet another colourless substance the decomposition of which gives the totally colour-blind people their sensations. Prof. Ebbinghaus shows that two greys, one composed of red and green and the other of yellow and blue, and made equally bright, do not continue to be of equal brightness under changed conditions. This is supposed to show that complementary colours do not destroy each other. From this, C. L. Franklin concludes, "It seems indeed to furnish a quite unanswerable argument against Herring's theory or any theory in which complementary colour processes are supposed to destroy each other." It must be added that C. L. Franklin had come to a similar conclusion quite independently of Prof. Ebbinghaus.

In this way if there seems to be a necessity of several substances to be present in the physiological construction of the eye to see colours, then perhaps the theory of Wundt cuts the Gordian knot by assuming that there is a large number of fundamental colours and not only four. Sir Oliver Lodge suggests an electrical theory of vision. He only suggests this line of investigation and is not at all dogmatic about it as will be seen from the following words in his book "Modern Views of

Electricity": "Light is now believed to be emitted by perturbations in the orbital revolution of electronic constituents of an atom. I have also pointed out that the rods and cones in the retina are of a diameter suitable for responding directly to electric oscillations of the frequency of visible light; and by means of a graduated series of metallic cylinders facing a source of electric radiation end-on, have so to speak imitated a retina which is able to select and respond to vibrations of assorted pitch, after the manner of Corti's fibres in the ear. But at present there is no physiological basis for such an assortment of size among the rods and cones as would correspond to the three colour sensations, red, green and violet. Perhaps it will be looked for."

A parallel idea was conceived also by Dr. Dawson F. D. Turner, M.D., and a lecture with demonstration was given by him to the Edinburgh Medico-Chirurgical Society. Dr. Turner suggests that in the eye there is a source of electrical-energy—that a current is, however, prevented from flowing by reason of certain molecules in the retina being in an unstimulated condition. When light falls upon these molecules they become so arranged as to be good electrical conductors, and thus an electrical current is set up. This either directly or through nerve impulse gives a sensation of light. The different colour-lights affect these molecules to different degrees. This was shown by physical experiments on selenium, which is sensitive to the same kind of light as our eyes and most sensitive to yellow, the same as is the eye.

Grant Allen, while considering the evolution of the colour-sense, puts forward his idea of how colour vision is affected. He makes use of the belief in the sensitive nerve terminals. According to him the nerve terminals of the insect eye were tuned but so badly at first that they vibrated sympathetically with the whole

gamut of separate ether waves giving a symbolic picture of an eye without a colour-sense. But if we further suppose that under the influence of sundry incidents (causes unknown), certain among these nerve-terminals became restricted in the range of their sympathies, so as only to vibrate in unison with ether waves having a limited range of frequency, then we shall have a symbolical picture of an eye with a rudimentary colour-sense. Thus the eye evolved till we got the colour vision as we have it in man and other animals. Mrs. Christian Ladd Franklin's theory is that the eye contains two kinds of photo-chemical substances. One of these is decomposed by all kinds of light and by this action of decomposition on the nervous organs of the retina gives the sensations of black-grey-white series; the other is decomposed in a particular way by red, green and blue lights, and gives these colours and their mixtures. The "duplicity theory" of Von Kries discriminates between chromatic and achromatic processes. Marion Luckiesh favours this theory as it explains several observed facts and is supported by experiments with colour-blind eyes. According to Marion Luckiesh, this theory is based upon anatomical evidence of the existence of rods and cones in the retina. The former are assumed to be responsible for achromatic sensations and the latter for both achromatic and chromatic sensations. The rod action is supposed to be largely responsible for sensation of light at twilight illumination and is in general more responsive to rays of shorter wavelength. The cones, however, are supposed to act only under stimuli of brightnesses represented by the range above twilight illumination and not to be greatly increased in sensitiveness by dark adaptation. Further support to this theory is found in the presence of rods almost exclusively in the retinae of such nocturnal animals as the owl and bat.

Dr. F. W. Edridge-Green propounds his theory of the visual purple. He believes that the decomposition of the visual purple by light chemically stimulates the ends of the cones, and a visual impulse is set up which is conveyed through the optic nerve fibres to the brain. The cones do not contain the visual purple but the rods contain it between them, yet the visual purple affects the cones and not the rods. He assumes that the visual impulses caused by the different rays of light differ in character just as the rays of light differ in wave length. Then in the impulse itself we have the physiological basis of the sensation of light, and in the quality of the impulse the physiological basis of the sensation of colour. He also believes that "the quality of the impulse is perceived by a special perceptive centre in the brain within the power of perceiving difference possessed by that centre or portion of that centre." His following words are significant and so are added here. "I have made numerous experiments which prove that unless light falls as well on a portion of the retina containing rods, it may fall on the fovea centralis without producing any sensation.....During the last ten years I have collected evidence that proves not only that there is a visual substance but that that substance is purple namely the complementary of pure green."

I like Dr. Edridge-Green's theory the best because

(1) it is based on observations, experimentation and repeated verification by himself for over ten years;

(2) it is simpler than most others and yet explains most things that other theories deal with;

(3) he does not overlook the strictly psychological part of the subject;

(4) he has answered all the objections raised against his theory, and

(5) he has successfully shown the shortcomings of most other theories.

However, some objections to his idea of the evolution of the colour sense will be discussed later on.

Joseph W. Lovibond has put forward his composite theory of colour phenomena. This does not explain colour vision, but somewhat bears on it and has the virtue of summing up several known facts and his own original results. The Nine Laws of Lovibond's Theory of colour phenomena are:—

(1) Normal white light is made up of the six colour rays, Red, Orange, Yellow, Green, Blue and Violet;

(2) The particular colour of an abnormal beam is that of the one preponderating ray, if the colour be simple, or of the two preponderating rays, if the colour be complex. The depth of colour is in proportion to the preponderance;

(3) The rays of a direct light are in a different condition to the same rays after diffusion, and give rise to a different set of colour phenomena;

(4) The vision is not simultaneously sensitive to more than two colour rays in the same beam of light; the colour of any other abnormal rays being merged in the general luminosity of the beam;

(5) The two colours to which the vision is simultaneously sensitive are always adjacent in their spectrum order, red and violet being considered adjacent for the purpose;

(6) The vision is unable to appreciate colour in an abnormal beam outside certain limits from two causes :—

(*a*) The colour of an abnormal beam may be masked to the vision from excess of luminosity;

(*b*) The luminous intensity of an abnormal beam may be too low to excite definite colour sensations.

(7) The vision has a varying rate of appreciation for the different colours by time, being lowest for red and increasing in rapidity through the spectrum until the maximum rate is reached in violet;

Note. This varying rate necessitates a time limit for critical observation: a period of five seconds has been adopted, as no variations are perceptible in that time.

(8) The colour of a given substance of a given density is constant so long as the substance itself remains unaltered ;

(9) Every definite substance has its own specific rate of colour development for increasing densities.

From this recapitulation it will be easy to see that though most of the theorists have done some good work towards attaining the ultimate truth they have also created a maze. Hence it seems justifiable to suggest a new theory that is based chiefly on known facts and is not intricate. I am taking the liberty to do this.

A New Hypothesis on Colour Vision

Taking simplicity and practical experimentation, Dr. Edridge Green's theory is the best. But when one considers the parsimony of nature this becomes difficult to swallow and some critics have made it so still more by counter-arguing. Taking simplicity, known data and parsimony of nature, the following suggestion is worth making, for further investigations. We find that an ordinary glass lens

without any colouring matter transmits very faithfully all the colours of any landscape that we may focus on a background as is very well demonstrated by the camera obscura. However, the camera obscura does not know what it experiences because it misses the two elements, the life and the brain, or their expression, the mind. Human beings and other animals have these two, which being the most important, should never be forgotten. At first sight it may appear that as the retina on which every picture is focused is almost in the brain it need not have the same kind of nervous activity as that of the toe. This may be so, but the known facts are that there are almost the same kind of nerves. Even then it naturally becomes a question how is it that the brain discriminates between the different colour sensations produced on the retina? This is the field of speculation which naturally is difficult to deal with for the same reason that we cannot explain how the tongue discriminates between sweet, sour, bitter, salt and insipid taste sensations. As far as the retina is concerned we have been able to get some definite facts about the mechanism of it and it is now best to take these facts only and to build up a theory thereon. This I attempt to do thus:—

(1) There are three substances in the eye especially useful for colour perception—pink (the visual purple), yellow and blue. These three primaries may look too old-fashioned, but I shall show later on why I take them;

(2*a*) There are cones and rods of which the cones with the help of the above three substances are capable of sending the sensation of colour to the brain for further discrimination. The cones are somewhat sensitive to white light also. Their functions are not so sharply divided though practically speaking specialized;

(2b) The rods take cognizance of light or otherwise, and of distance, but can interpret it only as light, shade or darkness. Thus even when colours are to be seen the rods must also work to take notice of some of the light which must form a component of colour sensations;

(3) There is a complete electric circuit between the retina and the brain, or, in more physiological words, electro-nervous circuit;

(4) There is a definite process of interpretation of which the most specialistic localisation in the brain can be called the visual centre for colour;

(5) There are psychic colours of the same hues as the physical we perceive, but of much finer nature than these, well beyond the physiological pigments of the retina.

Primary Colour Sensation

Now let us consider each of these statements. We know that spectroscopy shows that the probable primary colours are red, green and violet, because the spectroscope cannot break up green into blue, and yellow and violet into blue and red. Now if we did not have a prism or something to break up the white beam of light should we have been justified in thinking that white was the only primary colour? There would be another thing to conclude and it is that we have not got anything with which to break up the white beam. However the constructive evidence is that red, green and violet colours mixed spectrally behave like primaries and produce other colours. This one fact in the case of spectral colours is given more weight than the human experience of thousands of artistic painters, thousands of industrial colourists and millions of ordinary people to-day and of thousands of years past. The right way of looking

at the question is to say that the results of the mixing of spectral colours are the exceptions that prove the rule which anybody can find for herself or himself by mixing any of the three—red, blue and yellow—pigments. Whatever may be the results of blending spectral beams of light, one thing is certain, that we do not get such pigments to which these deductions can be applied. Whether it is the purity or impurity of pigments yet the fact remains that, for all intents and purposes, red and yellow make orange, red and blue make violet or purple, and blue and yellow make green, provided there is no chemical action.

Now we must have some positive evidence of the actual existence of such red, yellow and blue substances in the eye. Even hypothetically we can say that there must be some red because there must be some kind of modified blood in it. However even leaving that out of consideration, we have the evidence from experimenters. According to Helmholtz, Max Schultz discovered a structure in birds and reptiles which manifestly corresponded with what we should have expected to find. In the eyes of many of these groups of animals there were found among the rods of the retina, a number which contained a red drop of oil in their anterior end which was turned towards the light; while the other rods contained a yellow drop and others none at all. Kühne, while speaking of the retina of a shark, said, "In one of these eyes which had been laid open in the dark for an hour, I saw to my great surprise the whole of the retinal mass flooded by a clear purple solution, which when poured upon a plate, exhibited the same behaviour to light as the mass itself." A quotation from Edridge-Green already given also speaks emphatically about the visual purple and I have found that in his articles distributed in different magazines he has twice put pink in brackets after his terms visual

purple. However, one more statement must be quoted here about the existence of the yellow-substance in the eye. Edridge-Green says, "The yellow pigment which is found in the yellow spot probably acts like the yellow screen in photography, which, by absorbing the blue and violet rays of the atmosphere, renders visible that which would otherwise be invisible. This is further borne out by the fact that hunters in India are able to hunt later in the day than usual by using spectacles glazed with golden yellow glass." Now having shown that red and yellow substances are found in the eyes of animals, the existence of blue is to be shown. My notion is that the colour-perceiving cones are themselves blue, and so there is no need for any blue substances. The blue can act directly on these. This idea is quite in keeping with the economy of nature. We also know that dead people becoming cold, tend to be bluish. The veins on the hands of old people which look repoussé because of the sinking of the flesh also look blue. We know that blue gives a very cool sensation. I grant at once that this blueness of cones is an assumption on my part, but it is less so than assuming the existence of a blue liquid. The difficulty may arise in the mind of some people that if the cones are blue and if there is the pink liquid called forth then one should never see pure red nor pure yellow but purple or green. The answer is simple. Whether a substance looks pure red or not depends upon the amount of pink substance called forth by the excitation which will be in proportion to the exciting physical cause. This is why most reds when examined carefully show either a little bluish tinge or yellowish tinge. The same holds good about seeing the degrees of purity or lines of yellow and why most yellows have a bluish tinge or reddish tinge. Even in ordinary pigments we know that a violet colour can be slowly

made to approach red by the addition of more and more red. However, I am prepared to grant that those cones which work with the red and yellow substances may not be blue. In the eye there are also the other things to be considered, the psychic colours and the mind, and so, though on paper one may not be able to work out all details of the working of the eyes, they themselves under the mastery of the mind can modify and interpret them well. This idea seems to have struck Max Schultz also who says, "Blue light would be almost completely shut off from both, but would affect the colourless rods all the more effectually."

Now I must give some experimental evidence to show that the cones working without colour substances are likely to be blue themselves. While experimenting on after-image, I found that after gazing at an electric lamp for a sufficiently long time I had bleached the pink and yellow substances because those portions of the after image which were fine ruby red became very light red and later almost white, and those regions which were green became blue. Those which were inclined to be violet also became blue. Thus the green, missing the yellow, naturally became blue, and violet missing the red also became blue. In other words, the most fundamental colour was blue. However, it must be noticed that the duration of the blue was very short. The French psychologist Binnet found that amongst hysterical colour-blind people, the colours were lost in the order of violet, green, red, yellow and blue in one type, and violet, green, blue, yellow and red in the other type. My theory explains this well. In the first case the colour-visual substances being more affected than the blue cones, those in which the combination occurred were attacked first, then those of pure colour substances and finally the blue

ones. In the other case cones themselves being affected more than the substances, the combining sensations went first, then the pure blue sensation and then the yellow and red. These I look upon as good proofs of my theory. It must be here added that the distances between cones and rods are not of miles, and hence the excitation of one is likely to make some impression on the other. When there is some trouble in the throat, people often feel a sympathetic pain in the ears. The same can happen and I believe does happen in the eye, and this causes the phenomena of simultaneous contrast. We shall see more of this when I speak of my experiments on after image, etc. Before going to the other points of my theory I will say a few more things to show that it is no less scientific to say that the three primaries are red, blue and yellow than to say red, green and violet. It was indeed highly gratifying for me to find the following words of no less an authority than Edridge-Green supporting my own views. "They also support the conclusion at which I had previously arrived from the study of colour fatigue that yellow is a simple sensation and not compounded of a red and green sensation." Edward Grubers, while speaking about the defective perception of colours, says that those who can see only blue and yellow, find that most greens are either yellows or blues. This shows that the compound sensation of green somehow either gets analysed or that the blue and yellow excitations never get, so to speak, stereoscopically synthesised. It is more likely to be the former than the latter. Perhaps the neatest arguments that can be put forward against taking red, green and violet as primary colours, are as follows:—
According to spectroscopy.

Red + green = yellow;
green + violet = blue;

and yellow + blue = white.

∴ By substitution in the last equation we get (red + green) + (green + violet) = white.

i.e. red + violet + 2 green = white.

But the theory is that red + violet + green = white.

∴ There is one more green than is necessary, or in other words R + V + 2 G = R + V + G.

i.e. 2 G = G. If not, then one of these two white lights must be green and not the same.

∴ either R + V + G is not white or blue + yellow is not white.

If we grant to these theorists that R + V + G = white then it is apparent that

Blue + yellow is not white.

and it is shown that it must be green if not white,

∴ Blue + yellow = green

and so green is not a primary colour.

There is still another argument against this. We know that when a white beam is passed through two films, one blue and one yellow, the result is green. The spectroscopists say that this result is attained by subtraction, that is, the green is the residue. Granted that green is the residue, we come to this deduction that

Green + (the colours subtracted) = white.

∴ Green + blue + yellow = white.

They say that red + violet + green = white.

∴ blue + yellow = red + violet

but blue + yellow according to them is white

∴ red + violet must be also white.

∴ white + green = white, or again

$R + V + G - (\text{the colours of the films}) = G.$

$R + V + G - B - Y = G.$

$R + V + G - G - V - R - G = G.$

$\therefore -G = G.$

that is, the presence and absence of green are the same things.

Cones and Rods

The existence of cones and rods is not an assumption but a physiological fact disclosed by the microscope. The relative functions that they perform are based on circumstantial evidence. The first and foremost to consider is that, as they are distinct, they must both have separate functions. The two separate functions (not counting form in this connection for obvious reasons) are of light and colours. Here I may be allowed to add that I have not come across any writer who seems to have thought of perception of distance which appears to be not a distinct but a compound impression. When considering the phenomena of light they have paid attention only to light shades and darkness, but I venture to suggest that in this category must be included the perception of distance, of which of course a very intelligent interpretation may be given as being the compound impression mostly of light, then of form and of comparative previous experience. Here I wish to add that I am sure that there is something like distance-blindness, that is, the difficulty of measuring or the inability to measure approximate distance by sight only. People will some day be found who are in the habit of stretching the arm to put something in a certain place, but, misjudging the distance, either put things where there is nothing to rest them upon, or dash them into each other. Some of the extremely clumsy people may be only distance-blind.

The reasons why I look upon rods as mainly concerned with the perception of light are

(a) Some nocturnal animals have rods almost entirely, and practically no cones. At night time the light is comparatively less and so a stronger or more generous gift of light perceiving mechanism is wanted. As these gifts are more generously bestowed upon nocturnal birds, it is likely that they are for giving increased ability to see well at night time. In the fovea centralis, according to Kühne, only cones are found. Edridge-Green says, "A bright light may fall upon the fovea (the centre of the yellow spot) without producing any sensation and a perceptible interval elapses before we are able to see with the yellow spot, after the remainder of the retina, the fovea being the last point to convey a sensation of light."

It must be perfectly clear to all careful observers that at night the colours lose their distinctiveness, and of course in perfect darkness the physical colours are not perceptible even with our own eyes. Therefore those animals that live more actively at night time need not have much colour-vision in view of the following:—

(b) This also agrees with Grant Allen's original and well argued theory that those who feed on bright coloured foods generally have bright-coloured natural coating, as far as lower animals are concerned. The nocturnal animals generally do not feed on bright coloured foods and as a rule are not fruitarians; hence they need not have much colour-vision. The majority of nocturnal animals are not bright-coloured and do not make fruits their staple food;

(c) The entirely colour-blind people can perceive light, though not colour, from which it is easy to see that the rods must be mostly independent of colour sensations;

(d) It is found that the visual purple is present in the rods and so the cones must be colour perceiving mechanisms because we know that the liver secretes bile not for its own benefit but for the use of other organs. We know that the lungs purify the blood. This presupposes that the lungs are capable of dealing with impure blood to an appreciable extent. No sooner is the blood purified, then the lungs send it out for the benefit of other organs, which also shows that what it secretes is not for its own benefit primarily, though secondarily it is bound to affect it as the whole body works as one whole;

(e) The sensation of light being of greater importance than the sensation of colours, it must have a more stable or less intricate mechanism, therefore the rods are more likely to work independently of other aids than are cones likely to do. When a person suffers from certain slowly increasing eye affection she or he first loses the colour perception and then goes blind altogether. This shows that the weaker part gives way the earliest as should be expected. Edridge-Green's following remarks, though not altogether, yet somewhat are in agreement with my ideas. "According to all appearance the visual purple in the bird's eye is deficient in proportion as the retina is provided with other more stable means, the coloured globules of the cones. This is at least the case in the nocturnal and predaceous birds, and is entirely true as regards the pigeon and the fowl." The pigeon and the fowl of course are not nocturnal birds in the ordinary sense of the word.

Electric Circuit

There are two very useful stock explanations in the psychological and physiological difficulties. When some mental phenomenon is difficult to explain clearly the theory of the association of ideas gives it a nice varnish,

When a physiological phenomenon (and sometimes even physical) presents a difficulty the magic of electricity is used to dazzle the sight and overcome reason. In pathological difficulties the word functional or hysteric covers a lot of ignorance. Though I grant these, yet I believe that there does exist a kind of non-physical and non-physiological means of carrying message from different physiological points through physiological connections which for want of better words may be called animal electricity. Though metallic wires may carry electricity, yet we do not call electricity metallic. So though physiological nerves may carry the sensation message this messenger need not be called physiological. The existence of animal magnetism and consequently animal electricity is a proved fact, so much so that the most sceptical investigators of the phenomena known as spiritualistic make a very free use of animal magnetism for explaining most movements. The concensus of opinion of modern physiologists is that there is animal electricity not only on the surface of the body, but working even within it. The surface electricity can be easily proved by rubbing cats' fur briskly, as most people know. Finally no less an authority than Sir Oliver Lodge believes in it, though on one side he is a mathematical physicist and on the other side a studious believer in spiritualistic possibilities.

Almost the same idea, if not exactly the same, is expressed by the following words of Dr. F. R. Buchanan:—"The action of the brain and nerves upon the muscular system is affected by an agency strikingly similar to the galvanic. This agency or fluid which is evolved by the basilar portion of the brain, the spinal cord and the ganglionic system, is one of the lower species of nervous fluids. The nervous fluid or emanation which may be most appropriately termed nervaura, is essentially different in the

different organs. While the nervaura, or influence of the basilar portion of the brain, directly and powerfully stimulates the muscular system, that of the anterior region is incapable of producing muscular contraction, and tends to soothe or arrest. The nervaura of the basilar part of the middle lobe, in front of the ear, excites digestive organs, that of the superior organs adjacent to the part exciting firmness, diminishes the gastric activity. Thus every portion of the brain originates a distinct nervaura producing different and peculiar physiological effects upon others. The influence of the basilar and occipital organ is chiefly expended upon the constitution of the individual; that of the anterior and superior organs is more diffusive..... In the vast gap between our spiritual nature and the solid forms of inorganic matter, we have traced a regular gradation from solids to liquids, from liquids to gases, from gases to imponderable substances and agencies, from imponderable to various species of nervaura coming from the basis of the brain to the higher form of mental emanation, proceeding from the anterior superior portion of the brain." Certain medical men, from some observations and a little experimental evidence believe that there is a complete electric circuit between the eyes and the perceptive brain centre. So this element of my theory is not a pure assumption of my own.

The Visual Centre and Its Probable Colour Differentiation

When I first got the idea of the probable separate centre for colour preception, I thought it a very bold proposition to put forward considering especially the fact that the abuse by some charlatans of the science of phrenology has scared away so many enquirers. The only trouble about the popular phrenology is that it has planned out the whole of the brain surface area for all intellectual abilities and left no room for the differentiation of various

motor abilities. These difficulties, and the extreme scepticism of people who have not either reflected carefully or investigated open-mindedly, lead me to treat somewhat lengthily this point in support of my theory. The students of zoology know that even in some animals there is hermaphroditism. However, the two sexes eventually have got separated. All the four limbs of some apes are either four hands or four legs, yet these also get differentiated into arms and legs. Then again the two arms in human beings became differentiated for different kinds of work, and sportsmen (especially those going in for high-jumping) will assert that one leg is decidedly better for the final leap up than the other. Then even the hand differentiates the work of its fingers, as in writing the fore-finger always presses the pen down; the middle finger does the lifting up at the end of every definite stroke; the thumb keeps the pen in position and also pushes towards the right hand in right-handed writers, and the whole is guided by the hand through the arm under the control of the brain. This is in agreement with the law of specialization as I have propounded in my thesis on "Continuity—from Electrons to Infinity". We know that mind and body work together. We know that in some smaller organisms, and especially in the cold-blooded animals, the life intelligence is spread all over the body and so comparatively the brain becomes proportionally smaller by comparison. Further, as life intelligence becomes more and more concentrated in the brain, the brain becomes more and more complex. A human being cannot live for any appreciable time after the head is cut off but the tortoise can live for hours and even days after the head is cut off. It is a question whether when it completely dies, it dies through lack of air and food or through the slow loss of life-energy and hence life-intelligence.

This difference between a tortoise and man is sufficient to show that in the higher stages of evolution the brain becomes more necessary for the body. Now as we have already seen, the body differentiates itself according as claims are made on it. This suggests, that when an action is basically dependent on two parts, both the parts will continue to work together for that action, and yet each will specialise for another action as the legs do in walking and in high-jumping. This differentiation and continued co-operation in bodily organs must produce parallel differentiation and continuation of co-operation in the brain. Hence there must come about in the brain the so-called zones either overlapping or having the necessary intercommunication and yet they remain specializing centres. Hence the visual zone and its inter-relating zones may have specialistic centres for colour-perception. However let us examine the actual existence of such localizations from experimental evidence.

Experimental Evidence

It is a fact almost universally acknowledged that the brain has two distinct hemispheres, as it were, and that the left brain controls the actions of the right half of the body, and the right brain those of the left half of the body. The brain becomes divided further into regions more and more. To prove this statement I shall quote the experiments of the best authorities in this branch of research on different animals. Prof. D. J. Hamilton, while speaking of the electric stimulation of cortical motor centres in the brain of the monkey, says, " Between the line drawn at right angles to the anterior extremity of the pre-central sulcus and that of the pre-central sulcus continued upwards to longitudinal fissure, there is a region the area stimulation of which causes opening of the eyes, dilation of the pupils, and movements of the head and eyes to the opposite

side." This centre does not seem definitely to be found in man. In man no part of the brain seems to be able to take up the function of the motor centres in the cortex, if they get destroyed. In lower animals, like dogs, such adaptation can take place. This also shows that the brain becomes more and more complex in the higher animals and has specializing parts. Goltz showed that when the motor cortex in a dog was completely taken out bilaterally there was not anything like the permanent loss of motor power exhibited by man if his portions of these areas were destroyed. The dog so experimented upon was for the first few days in a stupid and torpid state. He neither wished to stand nor walk, and did not take nourishment voluntarily, although when food was put in his mouth he readily swallowed it. In a few hours the lost consciousness returned. Two months after the operation he could stand, walk, run and even jump. In fact he was completely recovered except that his movements were rather clumsy. On another animal the stimulation of a centre on the posterior portions of the superior and middle frontal convolutions had the effect of making the eyes open widely, the pupils dilate and the head and eyes turning towards the opposite side. Prof. Edwards A. Ayers of New York says, " Most of these tests have been made on dogs and monkeys, their brains most closely resembling the human organ. With the animal anaesthetized and a small portion of the brain surface exposed, a delicate electric current applied to certain parts of convolutions of the brain will cause certain muscles to contract. For example the electric point may be put at one end of a convolution and cause the toes to contract; apply a little farther, the foot contracts; farther and the leg muscles act. Stimulation of what is now recognised as the centre of hearing caused an animal to prick up its ears and bark

as if it had heard a sound." This last example is excellent as showing the inter-relation of these centres. The animal had the hearing sensation which also excited the centre of control over the ear muscles, and more, those of the mouth also, causing it to open and also exciting even the centre for producing a bark. This will show that though these are specialistic, yet they are not so sharply defined or separted that a particular centre has no other functions. The following words of Prof. Hamilton bring us right into the realm of phrenology. "The localisation of the volitional centre of language possibly may be widely diffused over the frontal and prefrontal regions. Those famous for command of an extensive vocabulary are usually characterised by greet development of these regions." According to Schiff the different fibres run up to the excitable portions of the cortex, and thence impulses are conveyed to the motor centres whose locality is as yet undetermined. The so.called motor area of the brain would thus, according to this viêw, be the sensitive perceptive centre for tactile sensibility. So far many people will have no hesitation in granting the specialization of brain zones, but when I say that the perceptive centre has a sub-divisional centre for colour perception, some difficulty may be experienced. This colonr perception is the same as the light perceiving centres which has evolved, not only to be descriminative of light, shade, distance, size, and contour, but even of colours. This need not cause any difficulty whatever now that we have already considered this process of discriminative differentiation that goes on in the brain. However, my own theory does not stop here. I have a firm belief that in order to appreciate colour to the fullest extent one needs more than mere physioiogical mechanism. She or he, if not born with it, must evolve by volition a sensitiveness to colours. In short the wish to see colours makes

more and more colours observed and actually increases the power of perception. This means that with volitional practice those who were indifferent to colours can become sensitive to them and even acquire the ability to discriminate more sharply than before. This idea of mine leads me to suggest that the number of colour-blind people can be decreased or, in other words, that some kinds of colour-blindness are preventible. So let us first consider colour-blindness.

Varieties of Colour-Blindness

Right at the beginning that wrong though romantic notion must be removed that colour-blind people see one colour in place of another, i.e. the red-green blind sees red for green, and vice versa. What happens is that the impressions produced by both red and green are not sufficiently distinct, and so there is occasionally a confusion between the two and the wrong names are used. Most writers on colour-blindness have begun with those who are dichromic or see only two colours, besides white, black and greys. However, I think something like monochromism is possible. Dr. E. W. Scripture of the Yale Psychological Laboratory refers to this possibility. "Still another form of colour-vision is found in monochromasy. What this colour is, it has as yet been impossible to say. In cases of congenital monochromasy it is undoubtedly not red, green or blue." However, we do know the colours of temporary one-coloured vision. This is not quite strong enough to superimpose itself so well as to destroy all other colours, but gives a kind of one-coloured vision. Everything seems to look yellow (or green-yellow) after a sufficiently large dose of calomel. To me personally it gives a preponderating yellow vision.

There is again the well known fact that some jaundiced persons see everything around them yellow, but this is not so with all

people suffering from this disease. In old age, the eyes sometimes become yellowish and also give a yellowish tinge to the atmosphere around the person.

Then again there is the state of erythropsia in which everything tends to look red. This is often associated with homeralopia, which causes difficulty in seeing in the twilight. Then again there is the green-vision in which a green atmosphere is given to all around the person. And yet another case of monochromatism is that of blue-vision reported by Dr. J. Blackburn of Liverpool in which a gentleman in business in South Africa was so perverted in his vision that he tended to see everything blue. After operation for cataract patients find that all objects are tinged with some colour, mostly blue. This is called kynopsia. Some get erythropsia as already mentioned. These conditions may be transient and recurring. I find it difficult to agree with the statement of Dr. Scripture that congenital monochromasy cannot be of red, green or blue. The next group of people are the dichromics who according to Edridge-Green can see only red and violet. But Clerk Maxwell, speaking of some varieties of dichromics, says that yellow and blue are the two colours which are perceived. The red and green are absent while the violet end of the spectrum is lost in the blue.

But in general the dichromics find a difficulty in discriminating between red, orange, yellow and green and also between violet and blue. They are not sure of grey or purple nor of the green that is inclined to be bluish. Next are the trichromics who can distinguish between red, green and violet, but are confused in distinguishing red, orange, carmine and yellows among themselves. On the blue side they have a difficulty with blue, violet and purple. They also confuse greens and greys and blues. Dr. Scripture asserts that there are some abnormal trichromics

and says, "We must infer that for such persons our reds and oranges are more yellow, our yellows more green, and our greens more blue to them." This looks like just a shifting of the perception towards the violet end of the spectrum. Then there are the tetrachromics who see red, yellow, green and violet and hence are perplexed about some reds and oranges on one side and some greens and blue on the other. The pentachromics see red, yellow, green, blue and violet. Their chief point of confusion is regarding orange. Their blue being somewhat weak they have difficulty with bluish green and bluish reds. Then came hexachromics who see red, orange, yellow, green, blue and violet. Their chief point of difficulty is about indigo. However because of the enormous number of people having this vision it is often looked upon as normal. It is indeed amusing how some of these insist on saying that there is no indigo, and yet look upon the pentachromics with compassion when these assert that there is no definite yellow. The greatest trouble about indigo is that in the spectrum it is between the blue and violet (rather the purple) but the disappointing indigo pigments (at least the majority if not all) are between the blue and green. In painting, to get a proper indigo my experience is that one must mix one's own colours. The heptachromics are the few—exceptionally few—who see red, orange, yellow, green, blue, indigo and violet. It sometimes seems to me that by careful investigation we can find some who are octachromic in as much as they can realise that the difference between violet and purple makes them as distinct as are blue and indigo or even more so.

Classification and Cause of Colour-Blindness

The classification of the ordinary colour-blindness from actual observed facts is as follows:—(1) the condition in which there is inability to see one of the six usual colours of the spectrum and (2) in which the

length of the spectrum is truncated at the ends, either at both ends or individually. The difficulties of No. 1 we have already seen. In those of No. 2 not only are the red and violet ends not seen as such, but they are lost altogether in darkness. These people generally confuse pink and blue. Some colour-blind people can see colours quite well when sufficiently near, but not when viewed from a distance. Most people are affected in their discrimination of colours according to the intensity of the light, and some so much so as to be classed amongst slightly colour-blind. To produce the phenomena of colour-blindness one or more of the following causes are sufficient.

(1) The nature and intensity of the source of light which illuminates the objects of which the colours are observed. This cause is perhaps the most important, but is not often given much attention by ordinary people interested in the phenomena. The best light by which to test colour vision is sunlight. Prof. Hamilton says, "We do not suspect ourselves to be yellow-blind by candle light, because we enjoy pictures in the evening as much as in the day." On reading this statement I felt delighted to have such an easy means of experiencing colour-blindness, but on trying it I was sorely disappointed as I had no difficulty whatever with the yellow colour. However, those who have seen how the colours of things seem to change when seen by a mercury-arc-lamp, will realise the importance of always noting the source of light in making any kind of colour vision experiments. This lamp, though it gives a much higher efficiency than other lamps cannot be used in dancing halls and such places because the ladies would strongly object to their frocks looking different in colour from what they were when selected;

(2) Any pathological defect in the mechanism of the eye

that can affect colour vision especially due to the absorption of certain colour rays by the medium of the eye. This may be due to some trouble of the eye itself or to some disease of other parts of the body ultimately affecting the eye;

(3) Some defect in the secretion and working of the coloured visual substances;

(4) The defects of the cones but probably to some extent of the rods also. Though these may specialise as described, yet they are also likely to work in co-operation. The right hand may specialise in writing, but both the right and the left hand work together to lift a heavy burden. In the same way in cases of some special attempt to differentiate certain kinds of vision both the rods and cones are likely to make united efforts;

(5) Some defect in the electro-nervous circuits of the optic nerves;

Colour blindness due to these last four causes may be produced in both eyes or in only one eye.

(6) Some defect in the localised visual centre of the brain.

I think it advisable to show that this cause of colour blindness is more important than it looks at first sight. Let us consider the somewhat similar affections, word-blindness and word-deafness. In word-blindness a person cannot read printed or written symbols of thoughts which we call words. His eyesight may be quite good and he may see that the word is there but he cannot understand its meaning. When we look at cuneiform inscriptions, we see that they are there but they imply nothing to us and we behave the same as a word-blind person. A word-deaf person could probably read such inscriptions if he knew this language, but if another person knowing the language read them to him he would

not be able to understand them. In the same way somebody speaking a foreign language that one does not know seems to make sounds which we cannot interpret. These phenomena of amnesic aphasia include (1) loss of memory in regard to names; (2) paraphasia, or the condition in which a wrong word is unconsciously employed; (3) word-blindness, where an individual has forgotten the meaning of a written or printed word; (4) word-deafness, in which the person fails to understand spoken language though he is not at all deaf. This kind of inability is seen in writing also and is called agraphia. In agraphia resulting from word-blindness, the patient cannot copy written words. In agraphia from word-deafness the person cannot write from dictation. In motor-agraphia or graphoplegia volitional writing is lost. According to Prof. Hamilton, "Through the repeated stimulation of the nerves of sight, hearing, touch, etc., a particular condition of the cerebral cortex in relation with each of these nerves is at last brought about. The condition of the cortex manifests itself functionally as a mental residuum or memory of these various impressions. The centre in which these word memories are stored must therefore be the great starting-point of language, and clinical observation tends to show that it resides in the temporo-sphenoidal lobe, more particularly in the posterior two-thirds of the first, and possibly of the second temporal convulsions."

Here I wish to draw the attention of the reader to the idea of the storing of word memories which are some impressions brought about by our ordinary words and so are the psychic replica of these words. This will also explain how there can be psychic colours as replica of our colours that are observed. In Great Britain and abroad a strong opinion is prevalent that just as visual images are perceived so are also word images, or as Prof. Hamilton puts it,

"The area for the perception and memory of word images is alike with that for the perception and memory of objects in the material world. Clinical experience points to the occipital lobe, or the cuneus, as being largely, if not exclusively the seat of it." From the above observations, it will be quite apparent that colour-blindness may be due to the inefficiency of its perceptive centre and of some part of the whole system. All the convolutions of the brain work together. Let us once again consider the system that controls the acquisition and use of the knowledge of a language. This is called the occipito-temporal system and is made up of four specialistic divisions co-operating (1) the visual centre in the occipital lobe; (2) the auditary centre in the temporo-sphenoidal lobe; (3) the fibres of the occipito-temporal band uniting these; and (4) the peripheral apparatus (optic nerve, tract and cerebral expansion and auditory nerve and cerebral expansion) serving to connect the optic and auditory centres with the outer world. This should be quite sufficient to show the actual fact of specialisation and co-operation found clinically. According to Broca, when the integrity of the third left frontal convolution and perhaps also part of the second (which are essential for speech) is affected, word-blindness manifests itself. To sum this up in a simple way it may be said that:—

There is little, if any, doubt that

(a) there may be a specialized visual perceptive centre with a colour exponent,

(b) all the specialistic mechanisms may in certain cases work together, and

(c) any injury to any part of the whole system of visual perception may bring about colour-blindness as this is the most

vulnerable expression of sight and may be a symptom of more troubles to come;

(7) Some inefficiency of the psychic colour volition. This will be understood better by further reading of this book.

The causes of colour-blindness Nos. 2, 3 and 4 may be produced by too much smoking, too much exposure to light or by being too long in darkness, by over-straining the eyes or even by extreme excitement lasting for a long time. Sudden emotional shocks have made some people even completely blind. Accidents bringing about some concussion of the brain have affected the entire sight or colour vision by attacking electro-nervous circuits and visual centres. Such states of colour-blindnesses are termed acquired colour-blindnesses, because they happened to people who previously had clear colour-vision. The other cases are of congenital colour-blindness which may be due to these causes operating at birth. I believe that the colour-blindness No. 7 is brought about by racial carelessness towards cultivating the colour perception and even injuring colour perception by smoking, drinking and in some cases by overstrain. This can naturally become congenital and I consider that the number of the colour-blind can be reduced by quite fifty per cent.

CHAPTER II

PSYCHO-PHYSICAL ASPECTS OF VISION

Prevention of Colour-Blindness

Those who have followed me carefully will be well on their way to being convinced that the brain and its expression, the mind, play a very important part in colour-blindness. If so, then they will soon agree with my very bold proposition that colour-blindness is quite preventible if they will follow the ensuing line of argument. I believe that if to-day the educational authorities will take it into their head to make the cultivation of the colour sense one of the compulsory subjects in the elementary school curriculum, and if the grown ups will strive not to neglect it when immersed in the worries of adult life, then the number of colour-blinds will decrease. We know that some people having a bad memory can cultivate a good memory by certain exercises. It is almost universally acknowledged that the power of learning lines by heart increases as one does more and more of it. Professional actors, by constant practice, find it quite easy to learn their parts, while to amateurs it is comparatively difficult. People know that by doing mathematics they can improve their powers of concentration. These are purely psychic abilities improved. Coming to the purely physical abilities that may be improved by practice one has only to mention that the ability to lift weights may be strengthened by exercise and by developing the necessary muscles. However, colour-perception is a psycho-physical ability, and so let us see if other psycho-physical faculties can be improved by practice. By practice the sense of smell can be improved so much that very small differences can be detected, but the best proof of such an

improvement is the developed sense of touch of blind people who were once capable of seeing. They can better differentiate between things by feeling after becoming blind than before, because necessity makes them "will it". It is volition that makes the hearing of the blind so acute. When I was examining some blind people I came across one who had lost his sight some seven years previously. His hearing had since become so acute that he could "hear colours" almost as well as some born-blind. I speak of this in the chapter on psychic colours. Thus those who exercise this colour perception develop it and make it more capable of resistance to disease. Hence minor causes of colour-blindness do not affect them easily and approaching colour-blindness is thus prevented. If for generations some particular faculty is practically neglected, then it becomes sufficiently weak to become a hereditary defect because it ultimately affects the brain. Anything not properly exercised deteriorates especially if it is connected with life phenomenon. Witness the decreasing length of the toes of our feet. Prof. Hamilton makes the following suggestion about volition with regard to word-blindness, and I am pleased to quote it. "In the normal state of the brain the impression derived from the printed or written word symbol in reading is received evidently by the occipital lobe. Thence it is transferred to the centre for auditory word memories in the temporo-sphenoidal lobe by way of the occipito-parietal band, and therein is properly interpreted. This is evidently done by an effort of the will for it is the experience of every one that it is possible to read without transforming the written symbols into their corresponding auditory memories, while by voluntary concentration we can overcome this. Where, so to speak, the visual impression is not shunted on to the auditory centre, it is meaningless, and the individual is suffering

from temporary word-blindness." I remember having said to a medical friend that people without any pathological defect in the colour-perceptive system could look at blue and yet not know that they were looking at blue, and he simply smiled ironically and later said that that was impossible. I repeat that the will to see colours will make more colours seen and this will have the associated benefit of diverting the mind from the worries of business and social life. As the most important part of my theory of colour-vision and this postulation of the prevention of colour-blindness are aspects of brain centres and psychic volition I think it desirable to show now to what a great extent the power of mind or will can subjugate the body. I have already referred to the improvement of certain faculties like hearing, feeling and smelling that can be brought about by practice with a determined will. Such results are not really surprising, but similar powers in some people have developed to the extent of controlling some of the automatic actions such as, for example, the beating of the heart. Tuke has mentioned the case of a person who could at will accelerate the heart beats by ten to twenty in the minute. Tarchanoff experimented on a person who could increase the heart beat by thirty-five in the minute to find out whether this was due to a deficiency in the controlling power of the vagus, but to his great surprise he found that it was due to increased control over the accelerators. Some people have under voluntary control the inhibition of the heart, and the case of Lieutenant Townsend is pretty well known. "He had the power, at will, of arresting both heart beat and respiration and would be in a trance, as if dead. His body began to cool and became stiff, the eyes stood immovable, and finally he became unconscious. In a few hours afterwards he recovered." Such cases being so exceedingly rare and only

accidental and not cultivated in Europe, it was necessary for physiologists and pathologists to suggest that somehow the accelerating centres in one case or the vagus centre in the other case, either came nearer to the will centre or got connected to the will centre. This explanation looks like inventing a miracle to explain an easy possibility. If the reader will refer once again to my quotation on will connected with word-blindness (which shows how in learning a language we bring about inter-relations between different centres), he will be able to see that in this matter also an inter-relation can be brought about by constant effort and development of will and by going through a course of psychic culture as the Hindus can do. Such control over the inhibition of the heart is not such a very extraordinary thing amongst the great Hindu psychics. Sometimes foreigners going to India expect to find such wonder-workers under a signboard and so they often fall into the hands of skilful charlatans. Those who go in order to learn and who show no air of superiority or disdain for the people of the country, can ultimately win the favour of such people and see these wonderful psychics. I have come across one near Bombay and have seen legally testified papers giving European medical evidence that he lived in a state of trance for twenty days. He told me that he did not find it absolutely necessary to live on non-meat diet during his training and he even ate meat though he was of a Hindu community. However, the very careful investigation into such powers, carried to the point of what may be called human hibernation under the auspices of H. H. Prince Ranjitsingh for the sceptical scrutiny of an English professor has proved beyond a doubt that with proper culture such powers can be attained. A short report appeared in the Christmas number of the Popular Science Siftings of 1918. In this last case

the Hindu yogi was put into a metallic coffer which had several locks, and the keys of which were placed in the hands of different sceptical people. The coffin was buried underground, corn was sown on it and it was left there for fifteen days, surrounded by a specially built house carefully locked and watched by the Indian Mohammedans, who are always inimically disposed towards Hindu culture, counter-watched by some followers of the Hindu psychic. (Let me add that I do not belong to either of these communities and am speaking impartially.) This ought to afford sufficient proof for any one who has an open mind that volition can improve colour-vision and, having made it sufficiently strong, it can resist the action of tobacco and such toxic substances as induce colour blindness in weak colour perception. All this is merely arguing the probable fundaments of my postulation, but now we must consider some positive evidence.

It is a well known fact that the percentage of colour-blindness in men is much greater than in women. It is also known that though colour-blindness may be passed on from parents to offspring, yet daughters are less inclined to be colour-blind than sons, and that though a daughter may not inherit colour-blindness, she can be a carrier of it, and pass it on to her sons. There are the Mendelistic ways of explaining these facts which I do not discard, but add my own explanation to them as being equally important and more enlightening. This will be further corroborated by other observations I shall make later. Girls, because of their greater interest in personal adornment, from early childhood make greater efforts in the discrimination and appreciation of colours than boys do. They talk amongst themselves about their dress and compare the colours of their frocks and ribbons as boys do not. This constant practice improves and strengthens their colour vision

system, so that when as a result of higher education heavier demands are made on their eyes these are less easily affected than those of boys which are not by that time as well developed but even allowed to remain in a very weak state. To increase this affliction, as it were, boys and men smoke much more. Recently women have taken to smoking, almost as much as men, and as they are also slowly unsexing themselves in such countries as England, and so if they will soon take less interest in their garments and therefore in colour, both sexes may ultimately be equal in the proportion of colour-blindness. Such a state of affairs is very undesirable, as will be seen by reading the subsequent pages of this book. In the case of the so-called inherited tendency to colour-blindness, the same argument is true that the exercise of the colour vision by a girl slowly overcomes the inherited weakness and though she may not have perfect colour-vision she will not be quite colour-blind in the same way as a boy. Now when she has a son and a daughter, they will inherit this inclination. The constant effort of the daughter to see the colours will improve her colour vision, which will become better than that of her mother, but the boy who has inherited the tendency from a mother (who though not colour-blind has an inherited inclination towards it) will show signs of colour-blindness if he is not somehow led to make special efforts to see colours. Moreover, the early approach of colour-blindness will be more certain if he indulges in excessive smoking at an early age. Here I must add that in those cases of girls in whom the inherited tendency is so strong that ordinary efforts cannot counteract it, they will be colour blind, for instance, in cases of inherited colour-blindness due to congenital syphilis. All radical defects in the mechanism of vision can cause colour-blindness such as cannot be prevented. Another fact as to

which the majority of investigators have agreed is that the exacting demands of modern civilized life have created much colour-blindness, while in the past a state of perfect colour-vision was evolved by most of the human races. On this point I must give a quotation from Grant Allen, "There is good reason for believing that colour blindness is far commoner in civilized communities than amongst savage tribes." Let me explain this. In a wild life the more acute a colour perception a person had the easier it was for her or him to perceive fruits and other foods and in order to do this constantly the faculty of colour perception was developed. Nowadays we get our fruits and foods mostly from shops. The same holds good with flowers as a general rule. Again in a wild state it was necessary to be able to perceive the animal foes as quickly as possible so as to be able to make good one's escape from the danger before it was too late. In civilized life we need not be on the alert for such enemies although we do have to watch the traffic. This fact also supports my idea that colour-vision improves with practice and that without volitional practice it deteriorates to such an extent as to create defective colour-vision. Yet another aspect of investigation will bear me out. It is found that the Quakers and the Jews have a much higher proportion of colour-blindness than other communities. Why? As far as the Quakers are concerned it is because their religion teaches them to look upon colours as base things that tie people to worldly pleasures. Quakers are not supposed to wear garments of bright colours. It is obvious that when parents are by religion so very much against appreciating colours, their children will inherit a weak colour-vision and in a few generations of suppression of aesthetics become colour-blind. Fortunately however other people give them opportunities to use their natural colour-vision.

Had the whole world become Quakers two centuries ago perhaps colour vision would have been looked upon as pathological today. The fact that they have twice as many colour blind as other sects, shows what an enormous difference the studied neglect of colour vision can bring about in a community. Sir Francis Galton goes so far as to say that the people who join this community are likely to be of weak colour vision. My theory is somewhat helped by his following words, "I may take this opportunity of remarking on the well known hereditary character of colour blindness in connection with the fact, that it is nearly twice as prevalent among the Quakers as among the rest of the community, the proportions being as 5.0 to 3.5%, one of their strongest opinions being that the fine arts were worldly snares and their most conspicuous practice being to dress in drabs. A born artist could never have consented to separate himself from his fellows on such grounds. He would have felt the profession of those opinions and their accompanying practices to be a treason to his aesthetic nature." Purity in religious worship, that is the place of worship to be without idols, statues, crosses and colours, is laudable, but there is no reason why one should not take sufficient interest in the colours of nature and of art and exercise this gift rightly. Now let us see what may be the probable reason for the high percentage of colour-blindness amongst the Jews. In past ages, especially the dark middle ages, when the Jews were treated in Europe in a most inhuman way, a Jew dared not draw any unnecessary attention to himself. If a Jew dressed well and in garments of fine colours, he was asked to give up a good part of whatever money he had. If he lived in a house beautifully adorned with fine colours, that was taken as a sign of wealth, and so brought persecution upon him. We all know how Richard Coeur de Lion imprisoned a Jew because the Jew refused

to give up a large sum of money and how he ordered that every day one tooth should be pulled out roughly until the Jew decided to give him the money. But even in those days Jews were not treated so badly in England as in other Christian and in Mohammedan countries. Then again at great pageants and in public places of amusement where colours were in vogue the Jews were not well received. Thus they could neither dress well, nor live well at home, nor live well out of doors, as far as colours were concerned. It is not surprising therefore that Jews have this much colour blindness. Now-a-days when the Jews are treated well in most countries and indeed the best of all in England, they very clearly show both the reaction, and the first stages of the renaissance of colour vision. The young Jewish girls at times striving at effects beyond their purse and at the same time letting loose their colour sense often dress in a conspicuous way. This is also recognisable amongst Jewish young men. Indeed in the past, shabbiness was the best protector of the Jews. See again the case of the Hindus. When a foreigner went to Bombay he came away with the impression that all the Parsees are the rich people in Bombay and the Hindus the poor. Excepting for two or three outstandingly rich Parsee families, the majority of the rich Hindus have more money hoarded up than the rich Parsees who are rather extravagant. This general close-fistedness of the Hindus is the outcome of the necessity of living shabbily and like poor people which was forced on them during the Mohammedan rule. A rich Hindu in India in those days might be plundered by Mohammedans if he allowed them to have any idea of his wealth, except during the rule of a few good kings as Akbar the Great. However, Hindu culture had taught the Hindus, before the Mohammedans had put their feet in India, to love the beauties

of nature and they appreciated the colours of the rich Indian flora and fauna, and more than these, the colours of the glorious sunrise and gorgeous sunsets from day to day. Thus their colour vision was not so much neglected as in the case of the Jews in Europe. Yet some of the Hindu communities show almost the same loud taste as certain Jews and both these can boast much older civilisations than some others can. Take again the Japanese who are also lovers of colours but who have not suffered from such disabilities. Though they show a love for bright colours, even to-day their taste is not for the bizarre. The prevalence of colour blindness in England, and in Europe generally would have been less than the one in every eighteen persons which it is now, had culture and art been more keenly encouraged. Let me quote Sir Francis Galton on this point who says, "The long period of the dark ages under which Europe has lain is due, I believe, in very considerable degree, to the celibacy enjoined by religious orders on their votaries. Whenever a man or woman was possessed of a gentle nature that fitted him or her to deeds of charity, to meditation, to literature or to arts, the social condition of the times was such that they had no refuge elsewhere than in the bosom of the Church. But the Church chose to preach and exact celibacy, the consequence was that these gentle natures had no continuance and thus, by a policy so singularly unwise and suicidal that I am hardly able to speak of it without impatience, the Church brutalized the breed of our forefathers." Later on when religious customs changed in England and celibacy was not such a virtuous desideratum, the reactionary religionists like the Cromwellian Puritans set about removing all colour predilection and went to a greater extent than even orthodox Mohammedans might go. The sense of colour is one that can easily be affected by its

neglect over a few generations, but strikingly so when the neglect is prolonged over centuries. In the same way, colour sense or in other words colour vision, can be improved in a few generations, in fact more rapidly than that. To complete my remarks on this point I must give some experimental evidence to the conclusion arrived at by arguing the pure fundaments of my proposition supported by racial evidence. Fere demonstrated clearly by his experiments with his chromoptoscopic boxes, (containing solutions of very delicate tints), that with practice it was possible to discriminate between solutions which previously appeared to be without any colours whatever.

Conclusion

A certain critic, in reviewing a book putting forward a new theory, said that as the theory was built up on known phenomena the explanation of the phenomena was not novel, and therefore not conclusive. In other words, the critic wanted the theorist to put the cart before the horse, or advance a theory at random, and then pray to God with tears in his eyes that all the phenomena should work in harmony with his theory. My theory of colour vision is based upon proved facts, or at least provable or logically arguable possibilities. My chief claim is the bringing in and emphasizing of the brain and psychological aspects. I do not particularly put force upon any one system of mechanism as being more correct than others, but I say that in this constructional part, the facts that we actually know, when looked upon from the point of view of red, yellow and blue, as primary sensations, explain things quite satisfactorily if we do not forget that the intelligence that comes from life's experience will modify things slightly to suit special demands. I take the existence of some mental excitation similar to different colour vibrations to be the psychic colours to which I have devoted a chapter. How-

ever, all these things are of no avail if we cannot use them to remove any human inability which is not naturally desirable. Therefore I object strongly to this unmanly attitude that suggests that we cannot handle colour-blindness. I insist on saying that we can, and I have given my reasons. By paying attention to the following suggestions colour-blindness can be prevented.

(1) At childbirth great care should be taken to give the right hygienic treatment to the eyes of the children. The carelessness of untrained midwives has led many children to be blind from birth. Can there be any doubt that colour vision, being still more delicate, can be ruined in the same way?

(2) Young children at home and in school should be given exercises to encourage their colour vision and the desire to use it should be stimulated, as suggested in my book, "Colour and the Child;"

(3) The use of too much tobacco and other toxic substances should be discouraged. Society people could assist in this connection by making smoking very unfashionable;

(4) The spread of venereal diseases should be checked;

(5) More colours should be used in public places.

CHAPTER III

COLOUR PERCEPTION

Evolution of Sight

The first was the stomach. The stomach had a mouth. The stomach was the mouth. This strangely ludicrous beginning is made in order to give emphasis to the most important motive force, the need of food in the physiological evolution of a living organism. The sexual desire is the second most important force of physiological evolution, and the first of sociological evolution, when living beings began to be differentiated into males and females. The third most important motive force of evolution and the first of true spiritual evolution was the realisation of a hereafter. However crude the idea might have been, it discriminated human beings from the lower animals as having within them a moral force. Thus most of the abilities attained by all living organisms have been evolved in response to the demands of these three irresistible forces in a normally healthy living being. Darwinism throws some light on the evolution of colour sense. Grant Allen's theory traces it from insects, especially butterflies, but I find that this does not go back far enough and I wish to take the reader a little further back, starting from the cell, but will not weary him more than I think necessary.

The smallest possible living organism known and even imaginable is a protoplasmic cell that has at least some means of ingesting food. The best of its body forms a stomach and a part of the stomach is the mouth. A very interesting example of this is in the star-fish. When some food is such that sea-hydra cannot in the ordinary way take it in, it turns its stomach inside out and

brings it into contact with that article of food, partly digesting it, as it were, outside of itself. When it has reduced the food to a suitable condition it takes it in and turns the stomach in. At that time the stomach was the mouth in the literal sense of the word. As long as that first organism lived in a medium that was certain to provide an inexhaustible source of food, motion was not needed. In some cases it came about that a change of location was desirable, both for increasing the chances of food and also for avoiding the enemies which would, on discovering the residence of a group of organisms, destroy it. Hence motion was evolved. To attain this voluntarily it was necessary to have propellers in the shape of hairs, antenæ and limbs. The limbs were originally used only to push the mouth to the food and to avoid enemies and later on to find a mate. Movement naturally brought with it the danger of going into places where the food was not of the right kind, and where there might be enemies. To guard against such contingencies the eyes were evolved. A good example of which is seen in the blood specialist leech, which has ten eyes surrounding the mouth. However, now these rudimentary eyes by themselves not being adequate to discriminate sharply between things by sight alone, the nose, with its sense of smell, came about and generally went in advance of the mouth to make sure of the quality of the food the eyes had already perceived for such creatures to which smell could be useful. This is effectively exemplified by the caterpillar, which has eight eyes surrounding its nose, so that no nice smelling leaf can easily escape it. As organisms evolved more and more, they became less and less prolific in procreation, hence there became a great need for additional means of giving warning of danger to survive it. While the mouth, the eyes and the nose were busy supplying the food to

the stomach, a sentinel of some kind to give warning of any approaching enemy by hearing its movement was needed and hence the rudiments of the apparatus of hearing were formed. As we are concerned with sight only in this book, the consideration of the other senses need not be carried farther, but the attention can be confined to the study of the evolution of the eye. Tactile perception was the first of the senses. This became specialised in some parts so as to perceive vibrations as light, and to judge distance from heat. Darwin by his experiments on cotyledons showed that the perceptive parts were the tips. The perception in sensitive plants like the Venus fly trap is worth mentioning here. If some flies be hung or fixed at a short distance from the Venus fly trap, it slowly but surely becomes aware of this, bends towards them, and takes them as food. In other words, this plant perceives the existence of food in its close vicinity. The insectivorous plants that possess animal habits of eating insects, etc., like the pitcher plants, English sundew, Venus fly trap, and also drosophyllum lusitanicum, have the sensitive parts bright pink, and in pinguicula lusitanica are reddish, purple or even violet tints in parts.

The way in which certain creepers, starting from a dark place, rise by the most direct and practicable way to the point where they are sure to find light, is also somewhat indicative of the desire for light and a kind of perception as to its location.

Alfred Binnet says, "It is admitted to-day that certain Peridinia possess an eye, an organ which has hitherto been considered as the exclusive attribute of animals."

Again C. B. Davenport asserts, "There is much evidence that in many eyeless metazoa the whole surface contains such light perceiving substances. This is well known to be the case

in the earthworm." Then it comes about that a certain part of the whole surface of some living organism takes upon itself as it were the monopoly of perceiving light; that is to say, it specializes. Here the reader must pardon me for being a little irrelevant. When I expounded my law of specialisation in my "Continuity—from Electrons to Infinity" some people thought it to be only the law of the division of labour under a new name. This case in hand of any particular one spot of the whole surface taking upon itself the work of the whole surface is evidently not a matter of the usual kind of division of labour but illustrates my law of specialization. Such ocular spots are found in the flagellates, chiefly in those which are coloured green by chlorophyl. The most rudimentary eye, or a perceptive spot of the simplest kind is found in the euglenae. These spots are bright red and fairly easily observable because they form a good contrast from the uncoloured plasma of the anterior part of the body where they are generally found. Uroglena volvox, which are coloured by yellow chlorophyl, have such spots but they occur singly and the position is at the base of the flagellum. This is best observable in euglena viridis, a freshwater infusorial flagellate. A large number of Algeae zoospores have such perceptive spots in the anterior parts of their body; these have a beautiful ruby colour and probably perform the same duties as those of the Euglenae. The following quotation from the great French psychologist and naturalist, Alfred Binnet, will convince nearly all my readers about these rudiments of eye-evolution. The eye "spot is a small discoid or triangular mass, of jagged and irregular outline. It is formed of two material parts; for a base it has a small mass of reticulated protoplasm, and in the meshes of the protoplasm there are small drops of an oily substance, coloured red. This

red pigment which has received the name of hematochrome, is not without its analogy with the green pigment of the chlorophyl, because this latter becomes red under certain conditions. For example, the chlorophyl pigment which fills the entire body of the Hematococcus phevialis becomes red, when the animal enters into a state of rest. It is impossible to believe that these organs are not eyes, for they have the same structure as the eyes of comparatively higher classes of animals, such as certain stagnant spores of the algae which also assume a red tint. The eye of the Euglena is the simplest of all; it is even reduced to the maximum point of simplicity, as it is just composed of a spot of pigment. What induces us to believe that this spot is a visual organ is the presence of this pigment. In fact this pigment is found in the most elementary visual organs. A second argument might be advanced; the red pigment of the Euglena exhibits the same reactions as the colouring matter that fills the rods of the retina in the vertebrates. From among those reactions common to both, we cite the decoloration under the influence of light. It is impossible to believe that these organs are not eyes, for they have the same structure as the eyes of higher classes of animals, such as certain worms, turbellaria, rotifers, lower class crustaceans, etc. All these organs are similarly formed of a small crystalline globule enclosed in a small mass of pigmentary matter." These portions of pigment became attached to the sight-sensitive nerves, so that the elementary eyes were combinations of spots and nerves. The action of the pigment is described in the following words by science: "The pigment absorbs light rays and undergoes a chemical change as visual substance, and, as a result of the action of the luminiferous ether, it discharges kinetic energy, which stimulates the terminations of the nervous end apparatus."

Small insects generally possess very good working eyes, but some have compound eyes, to certain of which I have already referred, but here just an exceedingly brief survey of this matter will be made. In the compound eye of every ant there are 50 constituent eyelets; in drone bees 1400, and workers 3500; in the kitchen fly 8000; beetle, over 6000; dragon fly 13,000; hawk moth 20,000; Mordella (beetle) 25,000; some butterflies even 60,000. Generally in these galaxies of eyes there are two divisions; some are focused for distance, and others for the immediate surroundings. Some such compound eyes are so fixed that they cannot be moved, as in the case of a spider. However as the spider has many eyes he fixes some on the fly that may be caught in his web and others on the lines of his web where he has to put his feet. Some eyes that are chiefly needed for seeing in the dark have no power of changing the focus. Some again have focalizers of quick adjustment, but not sharp focus in retinal sensitiveness, as in fishes; others have keen focus but rather slow adjustment, as in man. Whether the power to focalise is for vicinity or for distance is affected by the nature of the media in which the animals live. Clear water fishes as a rule can focalize farther than those of muddy waters, but the catfish, living in dark caves, has no use for eyes and so to decide upon the quality of food it may swallow, it has taste buds at the outer end of its feelers. It is not altogether agreed as to whether all compound eyes give a mosaic picture on the retina of any one whole scene, or several small pictures, but in some cases it has been found to be a complete mosaic whole. The eyes of the other animals are almost the same as those of monkeys and man, but only the simian and human beings have parallel vision. This question of the evolution of sight (somewhat elaborate for

the purpose of this book) is entered into to show that where there is a greater use for eye the sum total of the efficiency of its formation and powers is also increased. In the same way those human races that show greatest predilection for colours are most evolved physiologically and socially. However, the point must be cleared that those communities of human races who have less use of colours in their culture were equally well evolved physiologically as others, but are now showing the signs of retrogration because of the neglect of that particular section of the sense of sight.

Dr. E. A. Ayers puts this law thus, "Nature holds to her exceptionless law that the talent unused by the sire shall be withheld from the son."

We shall see more of this in a separate chapter. However, this sense of colour is by no means a sense suddenly attained by only monkeys and human beings, but is attained also by much lower animals in different degrees.

Discriminative Colour Perception

Many experimenters have made investigations as to the discriminative sensibility of plants and some very low animals to different colour lights. Sachs, Bert, Weisner, Flaunnarior, Siemens, Vines Ward, Famintzin, Yung and Davenport have come to conclusions well worth considering. C. B. Davenport sums these up as follows:— "The action of white light upon seedlings is the resultant of the action of the compound rays, and of these, the red tends to favour growth by rendering possible starch formation; the blue, on the other hand, tends to restrain growth, probably by introducing certain destructive (or controlling) chemical changes; and, in the dark, seedlings being freed from the restraining action of

the chemical rays, grow rapidly so long as the stored food products permit; and, in daylight, although the means of nutrition is provided, the presence of the inhibiting blue rays tends to cause slow growth. Upon other organisms whose growth is retarded by light, the effect of white and blue light must be quite the same; and the experiments of Vines and of Ward upon fungi show that this is the case. The effective rays in retardation of growth are clearly those at the blue end of the spectrum."

When a human being feels happier because of being in a room adorned in his favourite colour, we are willing to grant that she or he agreeably discriminates that colour from others and also cannot help feeling happy. The best way in which plants can show their happiness is by growing more quickly under the colour they, so to speak, select. However, a little more than that is necessary to show such discrimination. It is very well known that seedlings reared in a room near a window will all have their tops turned towards the window. Yet, some do not. Seedlings of the phanerogams turn towards the light while those of the hypocotyle of the seedling of the mistletoe turn away from it. In zoophytes the endendrium and the hydranths grow towards light while the stolons grow away from it. If some light is allowed to fall on a vessel so that some parts are left in the shade or darkness, it is found that the fresh water planarians gradually accumulate in darker parts of the container.

"All these cases, then, lead to one conclusion, that organisms may move with reference to more or less intense light—that there is such a thing as photopathy. Thus without multiplying cases, the results of experiments may be summed up as follows:

positively phototactic or positively photopathic organisms are such only in the presence of the blue rays," concludes Davenport.

According to Strasburger, the swarm spores of the algae Botridium responded to the blue and violet, but especially to the indigo whilst the green and ultra violet were alike without effect. Baranetzki showed that Myxomycitis like chlorophyllacious forms respond to blue rays only. Wilson observed that hydra preferred to accumulate behind blue glass, and to small extent behind green, but were indifferent to the upper violet rays and those below the green. Starfish deprived of eyes favoured blue rays like the photophil Rissoa. After some further experiments Davenport and his colleague come to the conclusion that some organisms have this double response to light; they may move in the direction of its rays, and they may keep in a certain intensity of light to which they are attuned. This shows that as the intensities of different colour lights are different various organisms discriminate between them. Coming to higher forms of life, we have been informed that daphnia and some ants are very sensitive to the violet rays. This discrimination or even this appreciation of colours in insects and other animals has been repeatedly mentioned by naturalists and often observed by ordinary people, but it was left for Grant Allen to work it up into a very ingenious theory of the colour sense being evolved by the first motive force, the demand for the right kind of food. Much before his theory it was well known to students of zoology that generally bright colours and other appendages were attained as means of facilitating mating. This fact presupposed that these colours had some special fascination over the animals to be attracted or in other words, they had the power to appreciate colours. Just as there was fascination for some colours, there was

also some apathy for others, as we shall observe later on. It is easy to see that if some insects were attracted by certain colours in some way or other, those colours were mostly beneficial to them, and hence they would directly or indirectly promote them. Again, those plants having such colours would be led to produce more and more of these, so that they could attract more and more insects which could distribute the pollen and fertilize them. Thus in nature the law of co-operation, which is the result of specialization, worked very efficiently for the evolution of coloured flowers and colour-loving insects. This natural desire of the insects to be in those localities where they saw their favourite colours had the effect of making them conspicuous both by numbers and by the contrast they made from the coloured flowers they visited. Hence they slowly absorbed (even in the literal sense) the colours of those flowers, becoming less conspicuous, and so when they were fully occupied in feeding themselves on those flowers, they had not very much cause to worry about avoiding their foes. Nevertheless, this idea of mimicry in nature has its opponents, but as we do not need it, we shall leave it here. With some sort of influence of nature, the colours of fruits and eatables produced an appreciation of colours in birds and animals. This theory is very carefully worked out by Grant Allen and we shall let him "summarise it." "Insects produce flowers. Flowers produce the colour sense in insects. The colour sense produces a taste for colour. The taste for colour produces butterflies and brilliant beetles. Birds and mammals produce fruits. Fruits produce a taste for colour in birds and mammals. The taste for colour produces the external hues of humming birds, parrots, and monkeys. Man's frugivorous ancestry produces in him a similar taste; and that taste produces the various final results of human chromatic arts."

I adopt this without qualification, though I add that sexual

selection and intellectual curiosity, and as their starting point the unquestionable desire to solve the mystery of death, have taken a very great part in the final attainment of colour sense. This is an appropriate point at which to mention briefly the second theory of Grant Allen. His second theory (which to me appears to a great extent a corollary of the first, and as such I have already referred to it) is that as a rule the animals feeding on brightly coloured foods are brightly coloured themselves. This theory is not so well correlated as the first one, and he does not seem to give any definite reasons, as I have already suggested. He shows that amongst insects the most brilliant orders are the Lepidoptera (including butterflies and moths) which feed upon flowers while the carrion-feeding flies are generally dark and inconspicuous; whatever beauty they possess being due to mere surface play of interference colours. Again, beetles or coleaptra show similar results. The carrion feeders are for the most part black and unattractive, but the brilliant species are often flower feeders. Again, the smaller saurians, most of which live amongst woods and trees and eat fruit as well as other things, are comparatively beautiful, whilst the large alligators and crocodiles that mostly haunt the water and live on animal food, are repulsively ugly. Amongst birds the mixed-dietarian eagles, hawks and falcons and especially the carrion feeders like vultures and condors, have dull plumage whilst the fruit and grain-eating peacocks, parrots and humming birds have brilliant plumage. As a rule fruit-eating birds are brightly coloured and seed-eating and omnivorous birds are dull brown, black or otherwise dingy. This is particularly remarkable in pigeons. Those that are ground feeders, eating worms, etc., and living a terrestrial life are not so beautifully clothed with feathers as those living a more aerial life, and

consuming vegetarian food. Grant Allen says, "When we come to the essentially arboreal mammals however, the rodents and the quadrumana, we get many comparatively brilliant species. The squirrels are often remarkable for their beautiful colours, and the so-called flying squirrels call for special notice in this respect. The contrast between these pretty little creatures and their allies, the mice, rats, beavers, and water voles, strongly brings out the peculiarity of their hues. So too the purely frugivorous monkeys give us a variety of colour, which we find nowhere else among the mammalia; and in the scarlet faces of many among them, or, most remarkably of all, in the bright red and blue of the mandrill, we have the only pure tints which are to be found in the whole class. Almost all ornamental appendages of animals are modifications of the skin or its equivalent. Whatever we may think of their functions, we must agree that they are, on the whole, products of high vitality. Hence we can understand why the more active and energetic sex should possess a greater number of highly developed dermal adjuncts, and should often display much brighter colours than the females." It was to bring my reader up to these last few suggestive sentences, which bear on my idea that colours have something to do with the sociology of animals, that I have given so much space to the second theory of Grant Allen that the animals feeding on bright food have brighter covering and that such coating shows, as a rule, greater vitality. This also strikes at the particular point I wish to stress, that colours are not superficialities, but have a purpose and meaning, and that they are vitally connected with the first two motive forces of physiological evolution, the demand for food and sexual gratification. If this is shown, even a little satisfactorily, the reader will see that colours must bear some relation to our psychology, because human beings also have to answer the

demands of hunger and sex, besides those of the moral force within. However, before entering deeply into the relation of colours and human psychology, let us just cast a glance at some special features relating to this quality of animals other than human beings, namely, colour preference and apathy.

Colour Preference and Antipathy in Lower Animals

Reference to colour preference in animals has already been made, but to make the matter a little more conclusive we shall go somewhat further and consider especially the point of view of the likelihood of colours being pleasing or displeasing to these animals. According to Gratier, those animals which liked darkness had a preference for red, and those which preferred light, had a liking for blue. The common worm, with head and tail cut off, preferred red to blue nearly as much as when uninjured. The triton and cochineal, with eyes removed and heads covered with wax, still had a delicate sense for colour and brightness. The flea infesting the dog had a finer colour sense than the bee, while nearly all the animals Gratier investigated were more or less sensitive to the ultra-red rays.

Cockernell and F. W. Anderson found that yellow was the most attractive to insects. Red appears to arouse emotion among fishes and birds; mackerel and perch are caught by the temptation of red baits. Prof. Bert found that the daphnia were especially sensitive to yellow and green. Kuhne of Heidelberg proved conclusively that an enormous majority of frogs exhibited a distinct preference for the colour green over the colour blue. However, blind frogs showed no preference. Lubbock showed that ants preferred red and green to other colours and that though there was this apparent preference there was more certainly an antipathy for violet rays. He says, "Thus then while the ants have to choose between the violet and other coloured glasses, they

will always prefer one of the latter, the effect of putting over the violet glass a layer either of sulphate of quinine or bisulphide of carbon, both of which are quite transparent, but both of which cut off the ultra-violet rays, is to make the violet glass seem to the ants as good a shelter as any of the other glasses. This seems to me strong evidence that the ultra-violet rays are visible to the ants." He experimented with bees and wasps and came to the conclusion that bees preferred one colour to another, blue being definitely their favourite; wasps did distinguish colours and though they had no favourite colour they seemed to be somewhat fascinated by vermilion. Thus we come to the strong antipathy in ants for violet rays, though there was, as it were, passive antipathy in other creatures in whom we have seen a preference for certain colours. The same kind of antipathy is seen in certain birds for specific colours, as for instance in sparrows for yellow, for they tear to pieces yellow crocuses. In higher animals the proverbial red rag to a bull very well exemplifies this. I have seen a lion getting quite excited in a zoological garden and puzzling us all as to what he was roaring and growling at, till the keeper came and asked a lady to hide her red sunshade.

I conclude this up by a quotation from Grant Allen. "The antipathy of male ruminants for scarlet and the curiosity which certain monkeys display with regard to bright coloured objects are the only facts in point which come under ordinary observation." I believe that any careful reader must feel that there is unquestionable relationship between colour and animal life. He should also be able to see that there is some relationship between animal psychology and colours, as it must be if colours had and have anything to do with life. Now we shall try to find out the relationship by studying colour preference in human beings.

CHAPTER IV

COLOUR PREFERENCE

The Causes of Colour Discrimination

Having progressed as far as to colour preference in lower animals, we shall now examine colour preference in human beings. This chapter will also deal with the results of my investigations in this direction by personal experimentation and postal enquiry. Before we enter into that I think it fit to consider the probable evolution of colour discrimination in man. The idea of Edridge-Green is that the eye would first discriminate between the rays which are physically most different in the visible spectrum, the red and the violet, that is, presuming the eye had become sensitive to this range. After these, green would be developed at the central point, then yellow, then blue and lastly orange. Edridge-Green is such a careful investigator that I have some diffidence in suggesting that his deductions are not quite right. It seems to me that there are several difficulties arising out of his reason for this development of colour discrimination. His idea is that it is the great difference in the physical stimuli of the red and the violet rays or, in other words, the difference of vibrations of the two that brings about this distinctive discrimination. Just let us apply the same notion to the sense of hearing between the lowest notes and the highest notes. If a person can hear the vibration of the note A and the vibrations of the note G of the same octave, is it possible that he cannot hear the notes B, C, D, E, and F? Or, if a man can hear the falling of, say, a needle and also of a girder of the same material, is it possible that he will not hear the falling of rods lying between these extremes? Again, if contrast makes these colours

seen, then it should also make the two sounds simultaneously distinct, or in other words, to make a man hear the falling of a needle, one must also drop at the same time a big girder. If they come one after the other, then there is not sufficient contrast that helps one to be realised by the other simultaneously but shows the difference between the two. If the difference between the two can be appreciated where they follow closely upon one another, then it certainly shows that each must be capable of being seen individually, though the difference may not be realised in some cases. If we strike A, and soon after G, they will show the difference between the two provided each one can be heard by itself. Again, Edridge-Green says this because of the fact that the dichromics see only red and purple. However, the point remains that they can see each of these separately, which shows that the contrast is not the cause of the first perception of these two, even if these two colours are sometimes mistaken one for the other. Even when the dichromic sees a spectrum, he does not see the red and the purple side by side, but quite divided by a band of grey, so that even in that case there is not a simultaneous contrast. I am not denying the fact that if not all, almost all our knowledge is comparative. This shows that taking this argument as an explanation for the cause of the order of colour discrimination is no new explanation but one fundamental fact that holds good with almost all our senses and mental abilities. We need a supplementary explanation for the order of colour discrimination.

It may be argued that it is easy to see that people should be able to realize the difference between black and white, or light and darkness, more easily than between two shades of grey. Granted that this is true, it only shows that the creature must be able to see white and black individually before it can contrast

them. If this is so, then it is obvious that contrast which is the outcome of the comparison between two extremes, cannot be the cause of the two extremes. It is likely that if we put one hand in boiling water and simultaneously the other in a bowl of melting ice, the difference between the two will be better realized than if we insert each hand consecutively. However, even apart from the boiling water the ice will be found cold, and without the melting ice the boiling water will produce the heating effect. Again, we find that if two extremes exist, generally one is pleasurable and the other the reverse. In most, if not in all traits of evolution, the beginning is at the pleasurable end, or the easier end, but not from both ends at once. So in all likelihood one of these two extremes will be more pleasurable and the other less. These are contrastable extremes because we know that it is very difficult to estimate true extremes as either pleasurable or otherwise. Neither extreme cold nor extreme heat is necessarily pleasurable.

Yet the study of colour predilection shows them both to be amongst the most favourable sensations. This means that there is some common factor which is the starting point. Considering the fact that colour perception is as much psychological as retinal, let us see if the evolution of any one faculty starts at two opposite ends. Let us look upon it from a mathematical point of view. Can a person begin to comprehend one and also, say, a million the same time, and working from both the ends come to half a million as the second stage? We know that the lower animals and even some savage human beings find it difficult to count more than four and that every child or animal has to begin with one and then slowly go to higher numbers before it can realize the higher number. When I first started considering this point,

the case of light and darkness seemed to me to go in favour of Edridge-Green's theory, but the more I consider the more these ideas seem to come to my assistance. First of all we have no reason to believe that we did not perceive grey before black or before white. As a matter of evolution we must have perceived grey before we perceived either black or white, while the other preceded even grey. We know that there are organisms which have neither eyes nor any perceptive power. This means that they knew only darkness. Then as we have already traced, with the evolution of perception, they began to have a slight sensation of light, then as it were a faint glimmer of light, and slowly more and more, till an eye was developed that could see light to the fullest extent, and either the removing or covering of the eyes would give them the realisation of darkness. Nature does not work by starting at contrasted sensations and gradually blending them, but starts from a complete whole and slowly differentiates it into discriminative sensations. In short, the idea of starting at two points because of the contrast is not without very great difficulties. The other difficulty with Edridge-Green's proposition is that he considers that colour-blindness should show the stages of colour perception. We have no reason to take it for granted that colour blindness works out in the exact reverse progression. Let us compare the state of word deafness. A person suffering with this disease, though not deaf to sounds, cannot understand the spoken language though he may be able to read it when written down. Although we know that in acquiring a language we learn to hear it before we learn to read it. So working backward we must always first forget the written symbols. The first thing a child forgets need not necessarily be that which has been taught most recently, all having been impressed equally.

There is no good reason to say that a relapse of any kind always is from the latest acquired power though that may be the usual rule.

Again, the absence of a faculty or an undeveloped ability need not always be of the same nature as a disability caused through disease. For example, a person who has not trained her or his voice is not in the same category as one who has lost the power to sing through some disease. As colour blindness may be the result of hygienic neglect at childbirth, or of overstrain, or of syphilis, it is not equivalent to that state of evolution when certain colours are not perceived. In my chapter on the prevention of colour blindness, I have shown that colour blindness may be due to the neglect of the use of the sense coupled to some weakness and also due to some organic trouble. In the former case it will naturally be a matter of time; in the latter it may be almost instantaneous and though Edridge-Green's theory can be shown to help my idea of the prevention of colour-blindness, yet the truth must be put forward. At times it looks as if the study of communal colour blindness as amongst the Quakers would indicate the order of evolution by retrogradation as being likely to be in converse order. However, the difficulty is that the most delicate parts of the system physiologically are likely to be affected first in both the groups of cases and the most delicate parts physiologically need not be the latest evolved. With such difficulties in the way of deciding the order of relapse and conversely of evolution from the physiological phenomena, I approach the question from definite grounds instead of purely hypothetical. My theory of the probable order of evolution is based on the powers of the stimuli and then on the stimulated. Yet it would be absurd to disregard the physiological evidence. My proposition is that the colours were seen by the eyes according to the powers of penetration and luminosity. Red

colour is the most penetrative of the colours for our perception of those that can be discerned by us, and therefore red was the first colour to be seen, as it penetrated the eye the most. We all know how striking red is which is the same idea in other words. Lovibond showed by his glass slides that he could add on by degrees that red took the greatest number or penetrated the most. We all know this from our experience of sunsets. There is more red in the sky at the sunset and soon after because then the rays have to penetrate the greatest thickness of atmosphere and most colours are extinguished, yet those of the red family penetrate through it. During a fog the sun appears red or orange because these rays can penetrate the atmosphere better. We know that red light and red flags are used as danger signals for the same reason. Yet at first it appears not a necessary conclusion that because red rays affect glass sl ides, atmosphere and fog in a certain way they will also affect our eyes in the same manner. I said that red penetrates these substances better than other colours do. This means that we become aware of the fact that red is not extinguished by our being able to look at it. In other words that ray has not lost its power to affect our eyes with which we become aware of it. This will at once show that I have not neglected the physiological element of this colour perception. Again if we find that in the non-physiological world, red is the most penetrative colour then the colour perception that is evolved in response to this as the most penetrative stimulus, must be the first to come to be accepted. If there is red and if the perception of red is of any use, then it is easy to see that the earliest colour seen must be red, especially among higher animals. Some may at once question that in such a case why are both red and violet seen by the dichromics ? Here I must offer my idea of the colour octave. The octaves do not

come in one plane as shown by circles over circles or by triangles over triangles. To me they are in a spiral progression like a spring. Each complete ring of the spring is of seven colours but the violet end of it though coming in an almost parallel position to the red has moved forward one space between the rings of the spring. Thus the other colour of these seven colours which has the nearest approach to red is purple. If in the spectrum we get any other colour beyond the so-called violet, it is not more bluish than the violet because having once passed the blue point, the blue becomes weaker and therefore the violet has naturally less blue than pure blue itself. In the same way beyond this violet there is still less blue. However, the eye ordinarily not being able to perceive ultra-violet rays, it is also not quite capable of perceiving easily the so-called violet rays, and hence this defect, which is a false sensation of darkness, gives the darker hue mistaken for increasing bluishness. Thus because this truly purple (but to our eyes violet) is the nearest approach to red, people who are dichromic see red and purple only. Again the penetrative powers of the ultra-violet rays are well known to most people. Thus this penetrativeness must begin rather effectively in the violet rays (as there can be no sudden changes) and help the penetration of red in the violet if it be a compound; if not, then its own penetration will be sufficient.

Besides, it must be remembered that what we know in the case of the dichromic need not hold good in the case of normal animals. We do not know that those animals who in their evolution first began to see red also saw purple. If they did I have given the probable explanation, if they did not we have no cause for anxiety as my idea about the red being the penetratively primary is not affected. If we were to compress the effect of

evolution of sight from darkness to light into seconds by revolving a disc having black and white sectors at a moderately slow but proper rate, we find that when black is followed by white or say mechanical darkness dispelled by mechanical light, then a sensation of blue is produced. This will explain my theory that in the spectrum, passing from the luminous end to the non-luminous end, the very inability to perceive the ultra-violet rays will cause a sensation which may be mistaken for increasing bluishness. If different colour-lights were exposed for extremely short periods of time and if a certain light needs the shortest time to be noticed, we can safely conclude that it is the most penetrative. The results of such experiments show that red is the most penetrative colour. The curve between critical frequency (at which the flicker disappears, that is, the shortest exposure at which a certain light just becomes imperceptible) and the logarithm of brightness shows that whereas in the red light curve, the critical frequency varies directly with the brightness but at low illuminations, the critical frequency becomes constant for blue light of various feeble intensities. The blue slope, though, is steeper than the red slope, its critical frequency lags behind that of red because of the constancy of the frequency of blue at low illumination. Hence red is the most penetrative, blue the least so, and most of the others lie between these two.

Latta records the case of a man of thirty years suffering from cataract on which he operated. The first colour he could distinguish was red, while green took the longest time. Edridge-Green also records the case of a woman who had become colour-blind through some ear disease. When she got back her colour sensations, they were confined to the red and violet of the spectrum. Young infants seem to distinguish either red or yellow as the first

colour. Another fact of very great importance is that the sexual organs in most animals have a reddish tinge. It would be only indulging in unnecessary sexual sensation to enumerate examples, but most of my readers will have already observed this fact, if not noted it psychologically. As I have already said, sex is the second most important force in the physiological evolution, and so we can quite see that if sexual organs are reddish, and as their perception in the case of comparatively higher animals is an important factor in sexual attraction and mating, it is evident that red should be the first of the colours to be seen by such animals as have red-coloured organs.

In beginning my theory of the probable causes of the order of the evolution of colour discrimination, I have said that it is due to the powers of penetration and luminosity of the colour rays. I wish to add that in the red first perceived by any eye, the sum total of penetration and luminosity will be greater than that of any other colour, though among colours the primary one to be most luminous is yellow. This is the reason why some children see yellow before red. Edridge-Green says that the colours seen by the trichromics are red, green and purple, because after red and purple green forms the point of greatest difference. However, we find that what he calls green is not really so green as it is yellow. It is green-yellow. Luckiesh says, "The refractive index being greater for rays of shorter wave length, the blue rays will be deviated or refracted more than the yellow rays, and the latter more than the red rays. Naturally the eye focuses for the brightest rays, which in ordinary light are the yellow-green or yellow rays." We find that even in yellow pigment the reflection coefficient is highest. The reflection coefficients of Zimmerman papers are Red 0.21, Orange 0.33, Green-yellow 0.67, Dull Green

0.49, Blue 0.23, Red-purple 0·16, Blue-purple 0.14. Again we find that a totally colour-blind person finds the spectrum quite uncoloured, but there are differences of brightness at different parts, the brightest being the situation of the green-yellow. Maudelstamm, Dobrowolsky and Peirce have all found the maximum sensitivity to lie in the yellows, or near the line D. Dr. Henmon of Columbia University also found that yellow was more easily perceived than the remaining colours where the times of perception are nearly the same.

These few facts that I have mentioned bear out my theory that the colours are perceived in the order of the greatest sum total of the powers of penetration and luminosity. The strength of my idea is in its simplicity. When things can be explained by matter of fact reasons, why do we need to invent mysterious miracles like the idea that a person can hear A. and G. but that all the other notes lying between the two cannot be heard? In short, the point of difference between two presentations cannot be the cause of their perception, because the presentations precede the realisation of the difference. Here a few words of warning must be added that though these are on the whole external causes as to why these two, red (including violet) and yellow (or green-yellow), are the colours first seen, yet with other colours appearing after these, the construction of the eye, when not quite normal, must be taken into account in certain peculiar cases where a different order of apperception of colour is noted.

If my theory is correct it may hold good to some extent in animals other than human beings. We have already seen that several animals are very much affected by red and yellow. This shows that perhaps for the sake of their food and sexual gratification they are very sensitive to even faint red and yellow

tints, but when very deep tones of colour are perceived they cause excitement or elation. The daphnia seem to prefer green-yellow and I think that it is again because, on account of its brilliancy, it can be perceived so easily and the less difficult an act is the more it is preferred by lower forms. Thus the preference for colours depends on four factors:

(1) The facility with which a colour can be seen, so that the apperception may follow the lines of least resistance;

(2) The extent of irritation a colour causes to the eye and other sensitive parts, pleasant or unpleasant;

(3) Whether the creatures are active or passive, warm-blooded or cold-blooded;

(4) Religious and racial predilection.

The first factor will depend on the luminosity and penetration of the colour and the physiological construction of the eye. The second will depend on nervous sensibility and psychic sensitiveness. The third factor, though apparently quite simple, is somewhat difficult to classify for our purposes. Witness the preference of hydra for blue light and then for green. Indeed it is a sluggish creature that does not like to be excited to any activity by other colours.

Besides the daphnias, that I referred to in order to show that if my idea of causes of colour preference is right, it may hold good with lower animals, I now mention that even spiders like red the best, though they do not dislike blue. This is according to the investigations of Peckhams. To exemplify further the third cause of colour preference, let me add that frogs turn away from red light and move towards blue light. They prefer green to red light and even yellow to red but the preference is not so marked as in the case of blue. According to Miss Washburn and

Bentley, the chub distinguishes red from green and from blue pigments, the discrimination being independent of the relative brightness of the colours. This fish first tried for the red bait showing what may be called a preference. This may have been due to cause No. 1. Cause No. 2 I think operates more in cases of higher animals, but most of all in human beings. In pigeons, though it is not quite decided yet, the preference seems to be for red in that bird of love according to Rouse's experiments. By experiments on the dancing mouse, Yerkes came to the conclusion that although the dancer does not possess a colour sense like ours, it probably discriminates the colours of the red end of the spectrum from those of other regions by the difference in the stimulating value of the light of different wave lengths, that such specific stimulating value is radically different in nature from the value of different wave lengths for the human eye, and that the red of the spectrum has a very low stimulating value for the dancer. This bears on my cause No. 2. Lubbock failed to find any colour preference in dogs, though the results of his experiments led me to believe that the dog could discriminate a little between colours. Stephen S. Colvin and C. C. Burford by their very careful experiments proved that dogs, kittens, and squirrels could be taught to distinguish other colours from red when red was taken as the standard. They also made a series of tests with one dog in which blue, yellow and green were used as standards and the various colours were introduced for comparison. The results showed that yellow was most successfully differentiated from the other two standard colours. The results with blue and green were identical. These facts will once more support my idea that the facility of colour discrimination depends on the penetration and luminosity. Colvin and Burford speaking about

the two dogs, on which experiments were made, say, "Although no pronounced colour preference is here indicated, there seems to be a tendency towards the red-orange and the blue and away from the green and the yellow. Another animal shows a preference for the orange, the yellow and the red-orange as against blue and green." As preference seems to be rather in doubt about blue, the safest thing to do is to take it that red-orange is probably the most preferred and green the least liked. This probable colour preference in animals lower than man may be well summarized by quoting the conclusions of Kinneman from his 7,000 tests on monkeys :—

"(1) There can be no doubt monkeys perceive colours;

"(2) Two grays having a given degree of difference in brightness are not discriminated as well as two colours having an equal difference in brightness;

"(3) For accurate discrimination of difference in brightness a difference of about 35 degrees of the white constituent of the gray is necessary;

"(4) The monkeys are able to distinguish colours from grays though the brightnesses are the same;

"(5) The male appears to have preference for bright colours, but blue seems to be discriminated against;

"(6) In two instances there were indications of at least a low form of general notion."

And yet another quotation must I give from Vitus Graher, who experimented on lower animals. "Colours cause pleasurable emotions in animals or the opposite, and that we are justified in speaking of a colour taste," he says.

Colour Preference in Man

This subject has attracted the attention of many investigators, but unfortunately little if any useful results have followed. Furthermore, the results do not even agree as to the most favourite colour. Garbini in Italy, Uffelmann in Germany, Binet in France, Wolfe in America and also Luckey, found that red was the favourite colour of children. From the returns of the Experimenters' Circle, I drew up a report for "Popular Science Siftings" showing that red was the most favourite. However, Baldwin found that blue was the favourite. Jastrow also found that blue was the most favourite, taking all ages. We cannot easily pass Baldwin and Luckeish who found that blue was the favourite with children, though we have the majority on the other hand. I have come to the conclusion that this puzzling position is arrived at because of neglect of the following points on the part of the investigators :—

(1) The question of age was not carefully considered ;

(2) The sex differences were overlooked ;

(3) The nature of the illumination whether artificial or natural was not observed ;

(4) No statement was made as to whether the colours were actually presented or were left to be imagined ;

(5) No note was taken as to whether the coloured objects had any prepossessing associations.

Causes of Errors in Colour Preference Tests

The difference that age will make in colour preference will be apparent to all my readers. My investigations have shown that lighter and brighter colours are more favoured by children under 14 than by persons over that age up to the age of about 45. After forty-five a sort of predilection for lighter and brighter tones is shown

again. This variation of preference is also noted by Jastrow who divided the statistics into five groups: (a) up to 18 years; (b) up to 24; (c) up to 30; (d) up to 40; and (e) upwards of 40 years. He says, "Blue is least selected by the youngest group, about equally by the three middle groups, and decidedly preferred by the oldest." But I think this method of division has no basis. It is important to divide children into two groups, one under the age of puberty and the other over the age of puberty, because this great physiological change that comes about in the child must have some parallel effect in its mental make up. My results show that there is a marked difference, as will be seen later on. This leads us into the second cause of confusion, that of the mixing of the sexes. I grant that before puberty there are no very great differences, but I know that they are sufficiently marked to deserve classification. In order to find this out, I asked some children to state what profession they liked the best, and found that though I expected some difference, the actual results were still much more decisive. The ideals of life and ambition are so very distinct in boys and girls that if colour preference have anything to do with mentality, there are bound to be differences due to sexual difference and consequent environments. I found that on the whole boys were greater lovers of movement than girls.

As to the third cause of confusion of results, I must confess that this did not strike me as so important till I saw the results procured by Luckeish. She found that under the artificial light of incandescent tungsten lamps operating at 7.9 lumens per watt, the order of preference was (1) deep blue, (2) deep red, (2c) red purple, (3) bright green, (4) blue, (5a) scarlet, (5b) red violet, (6) dull green, (7) yellow green, (8) orange, (9) orange yellow,

(10) blue grey, (11) yellow, (12) lemon yellow. The order of preference under daylight from a blue sky was (1) deep blue, (2a) red purple, (2b) bright green, (3a) deep red, (3b) red violet, (4) red, (5a) yellow green, (5b) orange, (5c) orange yellow, (6) dull green, (7) blue grey, (8) lemon yellow. This will show that red ranks higher under artificial light. However, in this test the difference was not so marked as it would have been had the mercury arc lamp been used.

The fourth point is of great importance and yet it seems to me that no investigator has considered the possibility of this throwing some light on characteristic mentality. If definite objects or shaped pieces of paper are given to children, then a limitation is imposed upon children's imagination and they instead of stating the real favourite, they will make the best of a bad bargain. Yellow may be shown and also red but it is very likely that champagne and cream will be omitted just as much as salmon pink and wine red. Again one does not think of presenting to children such colours as silver grey, copper red, old gold, etc. These are some of the colours that children have mentioned in my investigations. Yet another point to be remembered is that the investigators may not find it easy to have all the specimens of same brilliancy, saturation, etc. In my opinion the most important drawback with this material presentation is that the child mind is confused and the real favourite of the imagination does not find expression. If there is any predilection at all, then the child must have it in its mind, and not receive the suggestion from outside. It is what the child can imagine, realise and visualise according to the desire in the depths of its heart and mind as the favourite that can show some parallel psychological characteristic, and not what is suggested to it by artificial exhibition.

Some children may be so careless as not to have sufficiently noted the different colours to be able to name by memory any particular favourite. When shown some colours, therefore they are likely to choose one at random, or because of being impressed by the surroundings or the order of presentation.

The fifth difficulty is to a certain extent an amplification of the fourth one. Suppose that round balls of different colours are presented to children in order that they may name their favourites. The results will be stimulated in favour of red or yellow orange, because a round ball is almost sure to remind the child of an apple or an orange. If a child shows a desire to have a blue apple or a violet orange, there is something wrong with its mind. Again, if thin cylindrical rulers are presented, they are likely to remind the child of bananas, with the result that a child who is fond of bananas will select the yellow ruler though perhaps it would dislike a yellow tie or a yellow hair ribbon. Even when shapes of one plane are presented the same may be the result, a red circle is almost as effective as a red sphere in reminding a child of an apple. A hexagon may remind the child of some six petal flower or even of a honeycomb and consequently if fond of that flower or honey, it may note orange colour or any other. Some children have some definite notions, e.g. that all nice squares must be brown. This may happen because most tables are rectangular and generally of brown colour. Thus the associations of definite shapes will often rule out the particular favourite of the heart because of the preconceived ideas of the colours varying with the shapes.

To start with very young infants, we must speak of the baby of Mrs. Moore. This child, between the sixth and the forty-fifth weeks, almost always preferred a yellow ball to a red ball. It would be absurd to say that that was because it preferred an

orange to an apple, even granting that it was born with the instinctive knowledge. The simple explanation is that the sum total of luminosity and penetrative power of the pigment of the yellow ball, was more than that of the red ball, and as the eyes of the child were not yet sufficiently developed, that which could be seen with the least effort was the most desired. Yet there is the other side to this supposition. Very young infants are photophobic, and therefore those pigments that are the most luminous and penetrative should be liked the least. Whichever the cause the explanation may be the same, that is, that the sum total of penetrativeness and luminosity of the pigment of the red ball might have been too much and the child chose the lesser of the two evils. Personally, I hold to my first explanation, but think it well to mention the other possibility. It is known that yellow is a favourite of some very young children, but the percentage soon drops as the children grow up. In other words, the more developed the eye becomes, the less it likes a vivid glare ; hence in infants the results shown are, in my opinion, due to the working of the law of least resistance. Garbini studied this question so thoroughly and his methods were so careful that a pretty lengthy survey of his results should be given here. He states that for the first few days of its life an infant dislikes light, but ceases to be photophobic about the fourteenth day and then even enjoys it. This happens in some babies as early as the fifth day. " Between the fifth week and the eighteenth month, children show signs of distinguishing white, black and grey objects. It is not until after the eighteenth month that their chromatic perception begins." He considers that it is the centre of the retina, or the portion most sensitive to red and yellow, which is most exercised in young infants. " Between the second and third years children, both boys

and girls, were found to be most successful in the recognition of red, then of green (green-yellow), but they very often confused orange with red, and mixed up yellow, blue, violet and green." He thinks they tend to confuse a colour with the preceding colour in spectral order. "Under the age of three, children may be said inclined to be colour blind, and they are liable to confuse rosy tints with green. Between the ages of three and five they are able to distinguish red in any gradation, green nearly always with an occasional confusion with red, while yellow is sometimes confused with orange, orange sometimes replaced by rose, blue often not recognised in its gradations and violet often selected in place of blue. At this age, also (as in hysterical anaesthesia of the retina), blue seems dark or black. In the fifth and sixth years red, green and yellow are always correctly chosen; orange gradations are not always recognised, and blue and violet come last, being sometimes confused. In the sixth year children are perfecting their knowledge of orange, blue and violet and completing their knowledge of colour designations."—H. Ellis. Though there is that confusion of the most favourite colour on account of the mixing of the sexes, yet some investigators have not neglected this factor nor that of age. Mr. E. Barnes and Dr. Aars in America found that more boys than girls selected blue, while the girls preferred red more frequently than the boys. They also found that children's love for yellow decreased with age, even between the age of four and seven but more so with girls than boys. Barnes suggests that the tendency to select red increases with growing years. This is just a little difficult to understand. In my investigation I found that the preference for colours of the red family does increase up to about fifteen and then slowly falls, but seems to rise again about fifty as it does with most bright co-

lours. In an investigation at the Columbia University, the blue was found to be the greatest favourite, giving 34% and the second best was red, giving 22.7%. As this difference is from an examination of only a hundred students it is intrinsically smaller than it would have been had it been from a thousand, though mathematically it is the same. The results of the investigation at Wellesley College also showed blue to be most often selected, giving 32% as compared to red 18%. The other colours favoured in Columbia University were in the order of violet, yellow and green and at Wellesley was yellow, green and violet. Here it must be noted that the students were adults and not children. It seems that we can conclude from these experiments that blue is the most favoured, red the next, and green the least. This aversion to green seems to be recurring here as we saw it before. I am inclined to think that in these investigations there were more males than females, and that is probably why blue stood higher than red. It must be remembered that in blues, we have both the turquoise blue, and the navy blue, and in the same way while speaking of red, we must not forget that pink is also a member of the red family. Professor Jastrow of Wisconsin University, secured statistics from 4500 people at an exhibition, out of whom 2700 were men and 1800 were women. He found that blue was the greatest favourite, then red, after which followed lighter blue, blue violet, red violet, pink and violet. The absence of green, yellow and orange is remarkable. He also tried to find the colours least pleasing and came to the conclusion that the least pleasant were shades of oranges and yellows. He states, "While blue is pre-eminently and overwhelmingly the masculine favourite, the woman's favourite colour standing at the head of the female list is red.

"The feminine fondness for the lighter and daintier shades appears also in other respects.

"All men and women alike are much more apt to choose a normal than a transitional colour and a darker than a lighter shade.

"The three most favourite combinations are those composed of the three colours red, violet and blue.

"The combinations most generally avoided are orange with green, orange with violet, lighter orange with lighter blue.

"Those who make use of the 'no choice' column are between 25 and 30 years of age, and that lighter red is particularly preferred by those below eighteen years of age.

"Pink is confined to young girls and does not appear among boys, and that lighter violet is more distinctly preferred by the older women than by the older men.

"The favourite colour is extremely apt to re-appear in the preferred combination of colours.

"Blue-choosers who would also choose a combination in which blue occurred, would be 2.17 times the average chooser, those having such predilection for red 1.87, for lighter blue 3.88, for lighter red 3.82, for violet 2.85, and for green 4.44 times the average chooser; or on an average 3.18 times the average chooser: which means that a person who has chosen any one of the above colours as his favourite colour, is more than three times as likely to choose a combination in which that same colour appears as is the average chooser." Men obey this tendency slightly more than women. This is a fair review of the general work done in finding out the colour preference in lower animals and in human beings.

Relationship of Colour Preference and Mentality

Indeed it is interesting merely to find out facts about colour preference, although the time spent on it may not be justified if we cannot hope to find out something definite through it. My wish was to

see if any relation existed between colour preference and innate tendencies. With this as one of the aims I distributed 2,000 printed slips which asked the following questions :—

(1) Colour liked the best.
(2) Age, sex, complexion, colour of eyes and hair.
(3) Nationality.
(4) The month and date of birth.
(5) Actual occupation.
(6) Occupation liked the best.
(7) Remarks on health.

I thought that people were not likely to answer these truthfully if their names were asked for and so I added the note :—

"Your name, if possible, should be sent in, but your correct age is of utmost importance. Fill in this carefully."

People as a rule are rather sensitive and do not like the idea of losing their individuality or of being made conveniences, and so to flatter that vanity I thought it advisable to ask for their names but at the same time to leave them free. Though these leaflets were distributed through very good mediums, only 200 were returned. Two hundred forms were of no practical value and so I had to go about persuading the heads of institutions to help, but to little avail, until I came across Mr. Ernest Clarke and Mr. Cunningham Cole of Clark's College who secured for me 1,000 returns from their different branches. Very luckily these pupils came from the middle and lower middle classes and represented fair average. At first I had the uneasy feeling in mind that most of the students going to Clark's College would have their minds prepossessed for clerkship and office work. When I got the statistics I first of all wanted to find out whether my suspicion was correct or not, and I found that the selection of the

occupation liked the best did not seem to be affected in favour of clerkship by the training, which probably was forced on them by circumstances. To make sure of not having any undue preponderance in favour of clerkship, I decided to secure more statistics from other sources. I tried different teachers, and some colleges which had nothing whatever to do with commercial training, and got 1662 more returns. To my surprise I found that amongst these persons thus represented, the inclination was for clerkship. So all my suspicions about 1,000 returns of Clark's College being liable to affect my results prejudicially were removed and I received a fresh impetus to examine them carefully. Now I have been examining the total statistics numbering 2744 (plus 100 odd ones) and their combinations.

While classifying these into different groups I found that those who selected pink showed remarkable tidiness and even some similarity in their handwriting. Most writers did throw some light by their handwriting on the mental disposition when the other answers left the question rather doubtful. For instance one young man of 21 said that the occupation he liked the best was playing with girls. I was puzzled whether he was in earnest or fooling, and I found by referring to other things, but especially his handwriting, that he wrote a very sexual hand and that he was fooling a little as well, so I had to come to the conclusion that it was one of those very many jokes that are said in sincerity. One young lady of 22 stated that she liked talking the best. Again I had to bring the circumstantial evidence to bear on it. She had answered the questions as briefly as possible and very carelessly. Here then the talkativeness was not liked only for its own sake, but also because of a disinclination to do anything else as perhaps

everything else but flippancy was too tiresome.

It is not necessary to multiply cases to show that by asking one or two more questions than were absolutely necessary and preferably getting the answers in handwriting, some guidance can be got to decide puzzling cases. The other thing noticeable was that in returns from class-rooms generally birds of a feather had gathered together where they were allowed to chose their own places. The Jews appeared to be somewhat particular to inform me that they were Jews. Perhaps this comes from their extreme notions of superiority which to some extent may be the reaction to the attitude of the non-Jews who look upon the Jews as an inferior community. The same thing happens in the case of Indians also. From the remains of ancient writings we see that once the Indians looked upon the English as an exceedingly fine race and perhaps even superior. Now-a-days one finds that Indians are made to think exactly the reverse by the over-bearing attitude of some upstart officials. Even the third or fourth class Englishman going to India will admit no equal and even the third class Indians will bear no superior, so unfortunately we do not know when our Empire can be morally consolidated. Of the different kinds of students that answered my questions with an air to say "What is all this nonsense?" the law students must be awarded the palm for insolence. Nothing is good enough for these embryo politicians of law students, who know little, learn less than other professional students, think on serious matters the least, and yet talk more than all other students. It was a very wise step that stopped Indian students going in for the bar before getting some arts degree, as being qualified as barrister-at-law was the easiest think one could do in London and it gave young men swell-headed-

ness that was ruinous.

Classification of Colour Preference Returns

The statistics of 2862 returns was made up of 1418 males and 1444 females. This result was contrary to my expectations considering the fact that the proportion of males in this country has been smaller and it became still smaller because of the men being away from most institutions on account of the war. Again we know that colour is of greater interest to women than to men. My question papers I believe were circulated more among women than men. In spite of all these causes that would increase the female proportion I got them in about equal numbers. These facts show that women are more secretive and more suspicious than men and so were unwilling to answer questions, especially those bearing on their age and health. This was an unfortunate thing because it was from the female sex that I expected to get nearer the relation I wanted to find. Even in these days female psychology has not become so complex as male psychology because the female environment and occupational choice are not so varied as those of men; in short, their sentiments can be expected to be more true and direct than those of men. As an instance, most women find themselves either loving or hating much sooner than men do as men are much less certain about such things than women. Men do not make prompt decisions but try to think of many aspects. This sometimes leads them into perplexity, which makes them indecisive as to whether to love or hate, and so they are indifferent. Dr. Maurice Parmelee in his recent book on criminology says, "A vast mass of evidence has been accumulated by biologists and psychologists which indicates that the male sex varies more than the female sex. This fact should perhaps be correlated with the fact that the female resembles the child more

than the male resembles the child." Let me here add that child psychology is not so complex as adult psychology and hence it helps one to get at the fundamental understanding of such inclinations as are not much influenced by sex instinct. There are very few important tendencies that will not have sex influence and hence it is a splendid opportunity to consider tendencies without this influence or rather with as little as possible. Again when we say that men vary more than women, we mean that the male sex varies from the normal more than the female sex does also in the direction of unusual ability and genius, "so that the excessive degree to which it varies in injurious ways is doubtless fully compensated for by excessive variation in useful directions." I find that as far as colour preference and occupational choice goes the male statistics are more distributed than the female ones, though in colour choices the female are more discriminative. These facts will show that as female variations are not so great as those of males the approach to the average truth in them is easier. Yet it must be noted that the crimes of women are much more complex than those of men.

Once we have understood children and then female statistics, we can bring some light to bear upon those of men. In some respects men must be the same as women and in others different. These differences will probably be found by the study of children, where the greatest similarity will exist. These remarks will justify the division of the returns into the two sexes. In my returns also, blue is liked more by men than by women, the former giving 63%, the latter 42%. The males have 17% preference for red, including pink, while females have 28%. So, comparatively, my results agree with those of Jastrow that there are more blue-likers among men than among women and more red-likers among

women than among men. Yet the point must be made clear that from my statistics the most popular colour of both the sexes separately is blue, and that it is as it were spread over all ages, above thirteen pretty evenly, or so to speak forms a substratum of colour preference. Among males under 13 years, though males as we have seen chose blue the most, the percentage preference for red is 13 as compared to 11 for blue. This is true also of females before the age of puberty, who select 15% reds and 10% blues. So we can safely conclude that the favourite colour of children before puberty is red including pink, the same as blue includes both navy blue and turquoise blue. Before going further into these results, I will consider a little more the classification in regard to age.

It would be very short-sighted to overlook the fact that such great physiological changes as come about in a child attaining puberty will have some parallel effects on the mental outlook, so the first age group I decided to take was of those that had not attained the age of puberty. I assumed that on the average a boy attains this age at fourteen and a girl at thirteen. To make as sure as possible that a person was either on this side or that, the first group of boys was of those up to thirteen and of girls of those up to eleven. The second group was of a definite age: for boys it was fourteen and for girls it was twelve. I thought that a careful analysis of the inclinations of both boys and girls at these ages would throw some light upon the effect on the mind of the development of the potential sex element which must be advanced if not developed completely at these ages. The results, which will be discussed later, have not fulfilled my expectations because unluckily in my statistics those ages are rather scanty. The next group of ages was between 13 and 21 for girls and 15 and

22 for boys. I thought that by the end of these periods of years the new sex experience that had been evanescent would be more stabilized: that is, young men and women must get used to it though I do not say that its potentiality would be decreased by that time. The 21st year in women is also considered as the coming of age from a legal point of view. For boys, who begin later and are not so quick in learning of sex matters as girls are, I thought it advisable to give one year of grace to them. After these I wanted to have a group from 22 to 35 for women and from 23 to 35 for men and the next from 35 to 45 for both; but I found that my returns were not sufficient in number to make these groups of any value and hence I decided to have only one from 23 to 45 for men and from 22 to 45 for women. The age of 45 is approximately the age after which a woman as a rule does not bear children. The sex potentiality of men does not come practically to an end here, yet it is not of full strength, but as some age limit had to be selected, I took 45. I still had another group of upwards of 45, but as the returns were still more scanty than those of other ages I made a point of putting down every age separately in the tables I prepared for comparisons. Yet while considering colour preference for two age groups, I felt the necessity of further divisions than those suggested by the stages of sex potentialities. At the age of puberty blue is the most favourite of girls though the red seems to make an attempt to stay especially in the shade of pink. The boys at the age of puberty select green, though red is not left very far behind. Between the periods 13-21 of females and 15-22 of males, green is decisively the most favoured though violet is the second selection for both the sexes. Of green chooser of females of all ages this group alone supplies 77% and of males 30% as

against 72% of violet choosers in females and 22% of males. The predilection for pale pink seems to decrease in both the sexes after the age of 22, in fact it seems to almost disappear by this age. When I came to the group between 22 and 45 the statistical results put violet in the foreground for women, but with men the results were rather doubtful, though green seemed to be the most favourite. Blue seems to have dropped very much indeed in this period of age. Blue (which was the second favourite of boys under thirteen) ranks so low as to give only 1% in this group of 22-45, the same as pink did among girls of the last group. To decide finally as to which is likely to be the favourite or the most pleasing colour for adults over 21 years, I thought it best to make a special additional research. I took six 7" squares of violet, blue, green, yellow, orange and red, all of the same luminosity, size and shape. Grown-ups do not allow the association of ideas connected with apples, oranges or tables to affect their colour preference to any great extent, and so this test was not so questionable as with young children. I examined 118 people between the ages of 18 and 50 and found that 60 of these, that is, full 52%, selected violet as the most pleasing, while other colours had to be satisfied by dividing 48% amongst themselves. The order was Blue 25%, Red 13%, Green 6%, Yellow 3%, Orange 1% (really 0.8%). All my percentages are calculated on the slide rule and when there was a fraction under 0.5 I have dropped it, when over 0.5 I have counted that as one; therefore the totals of different percentages do not always total exactly 100, but 98 or 101 or so. I think I must draw the attention of the reader to the coincidence that this order of V. 52%, B. 25%, R. 13%, 0.6%, Y. 3% is an approximate geometric progression with the common factor 2. So taking everything into consideration, I am inclined to think that up to

the age of 18, green is the favourite for both, but violet is the most popular from 19 till about 35 years of age for both the sexes but with the difference that female preference will be for red-violet or purple, but with men it will be for blue-violet. After 35 years the blue becomes rather stronger in violet so that at about 45 years most people of both sexes will be approximately equally fond of blue as of violet. Summing up the whole, violet made up of 66% blue and 34% red will be the favourite of most, and the least disliked of others between the age of 18 to 50. It appears from my returns that after 45 the preference for lighter and brighter colours seems to appear again. Yellow is liked mostly by very young children under the age of 7 and by some old people over 60.

Wishing to bring negative evidence to bear on this subject I had also asked people to tell me what were the most disliked and annoying colours. The colour that was most disliked was yellow, giving 28%, then came green giving 18%, then came blue and orange both 16%, then the least disliked colours were red and violet giving 11%. So these results are in agreement with the positive evidence as far as the contrasts of yellow and violet go, and also the fact that blue stands at approximately the same place looked at from both the points of view. One thing can be said—and this is not a hasty judgment—that from the sex point of view blue is neutral. Thereby I mean that those who are fond of blue are rather inclined to be weak sexually, perhaps having the nearest approach to possessing masculine and feminine qualities equally.

Let us see if we can somehow correlate psychologically these results. My careful reader will remember that among children under age of puberty red is the most liked. In these children,

the sex matters do not make their minds complex. However, they must have some latent sex components in their character which will be made patent by the time of puberty. So I believe that their liking for red is an evolutionary provision. Besides we know that children from seven to fourteen are at a rapidly growing period and it may be that red is of some use to them in that also. Yet before red the yellow should have been considered. My own opinion is that the nerves of these very young children are not quite sensitive and that yellow helps them in making them sensitive. I look upon yellow as being a nerve excitant of a prejudicial nature and liked only by those who are comparatively placid. Children, though very impressive, are not overstrung at that age as a rule, and so can bear the luminosity of yellow and later the penetration of red. As to orange I am quite at a loss as to where to put it, but may be it is mostly mixed up with either yellow or red according to the proportion of its constituents. The fact that blue appears at the age of puberty, as the favourite of girls shows that the red has done its work and the new feeling though not sufficiently strong, needs no cooling. The age of twelve may be in an average girl the age lying between sexless childhood and potential womanhood, hence the neutral colour appears. This idea seems to be rather helped when we see that pink is a great rival of blue at that age. In such cases though red has done most work, pink has still some to do, and this may last for long periods past 12 years in the comparatively weak girls. Among boys we see green most favoured at that age and though we may say that blue and green are not far removed from one another, to me this is a little perplexing, considering the fact that green appears so powerfully in the periods between 13-21 for girls and 15-22 for boys. Is it that the sexual changes

in the boys, though they begin later than in the girls, attain maturity much more quickly? If so, we can understand the spontaneous liking for green at the age of 14 in boys because then we can see that green is liked, as it were, to counteract the heating effects of this new physiological change.

However, passing on to the periods 13-21 and 15-22, I have little doubt left that in these juvenile men and women, this new change kindles desires which under our modern conditions of life cannot easily be satisfied, hence a reactive predilection for green comes about. Please do not get impatient with these hypotheses because later on I shall show that evidence from other sources also seems to connect green with strong sexual feelings. Nature's forces are so beautifully arranged that in normal conditions they try to maintain a delicate balance. Why does violet become comparatively the most popular between the ages 22 and 45 and sometimes even earlier at 18 as I have already said? The probable reason is that with the hurried conditions of modern life, overstrained studentship, and the efforts to get along in the world, the nerves are at the other extreme from those of yellow loving children. The young people have become somewhat hardened to the harsh usage of the world, but their nerves have become too sensitive to bear yellow. The sex ebullition is also settled down but not weakened. More knowledge is gained. The senses are refined and so violet, the intellectual or rather distinctive colour, becomes favoured, to keep the sexual potentiality cool, but not so much as when it was a new fire, and also to cool the overstrained nerves and also be a tonic to them. It seems that green and violet are rather nearly allied though green is more sexually cooling and violet more nerve cooling and also acting as a tonic and serving to keep alive the sex instincts in a

gentler way. Other evidence, besides this, of preference, makes one believe that yellow and green are injurious in a very great majority of cases. Let me summarise this age preference for colours :—

(1) Yellow for children under seven.

(2) Red „ „ „ the age of puberty.

(3) Blue (for girls at the age of puberty, i.e. 12, and also pink in the case probably of girls weak in sex up to the age of about 18).

(3b) Green for boys at the age of puberty, i.e. 14. (This may be a very bright shade of green having an appreciably large percentage of yellow in it.)

(4) Green for both sexes from about 15 to 21 but in the cases of girls weak in sex, purple may overlap from about 16. Purple must have more red than blue, say 63% red and 34% blue.

(5) Violet with more blue than red (say 66% blue and 34% red) the favourite of both the sexes from 21 up to 45. There may be a little difference in the case of women whose violet may have a higher percentage of red in it, may be 45% red instead of the 34%.

(6) Blue the favourite of people after 45 and up to about 53. After this, red reappears and then yellow.

(7) A medium violet of about 50% red and 50% blue will be the most suitable and least displeasing for those places where all the ages and different temperaments are likely to come together.

I may add that though statistical results are the forceful basis of these statements, I have modified them according to

circumstantial evidence as evinced from other answers to my questions and other experiments I have made. It would be an unpardonable mistake in a book of psychology to forget the different human elements and rely only on numbers.

To get some of this circumstantial evidence I had asked other questions of which the most important was the choice of the occupation liked the best.

The replies regarding occupational preference I divided into those for (1) culture, (2) engineering, (3) clerical, (4) humane, (5) gastronomic, (6) playful, (7) non-stationary, (8) authoritative, (9) uncertain for males, but for females I dropped the "engineering" classification and put "domestic" instead.

Let me just explain why I chose these divisions and what they may broadly include. The "culture" division was to show any probable distinction from matter-of-fact manual occupations, and its relation to any colour selected. It included all fine arts, —painting, music, poetry, acting, sculpture, carving, embroidery, and ladies' dress-making. This division also included studentship etc., as comprised for centuries in the degrees of bachelors and masters of arts. These groups did not include any rough or toiling occupation, but those that were sedentary without being idle. Those alone who have sat from 9 a.m. till 6 p.m. and painted continuously, will understand how tiring and exacting these occupations are, though not of a laborious nature. These occupations do not show any indolence but great aesthetic and intellectual activity, combined usually with a disinclination to manual labour.

Fortunately I have also done manual labour from 6 a.m. to 6 p.m. in engineering workshops and even on the dirty boats on the dirtiest wharfs of glorious Glasgow. I say these things

only to show my reader that, having had the personal experience of writing poetry for weeks from 9-30 a.m. to 10 p.m. every day for a few weeks at a stretch while doing scientific experiments and engineering studies from 9 a.m. to 5 p.m. for over five years, I am in a position to speak of such different matters and capable of appreciating them all.

The second group of engineering in the case of boys is a little perplexing. To a certain extent we can say that it is peculiarly masculine but when we come to analyse it we see that in little boys it has factors common to little girls. My suspicion is that when these boys under eleven put down engineering as their favourite occupation they only think of it as play. Just the same as they start into motion some moving toy they like to do the same with some dynamo or other machines. Thus the so-called engineering tendency in young boys is not much more than playfulness which most happy parents like to extol as a great mechanical gift.

Further, the boys have no idea as to how hardworking a profession that of a mechanic is, and how extremely difficult it is to become an academically trained engineer. Why, even the adults, outside of this branch of education, do not know that perhaps the highest intellectual abilities are necessary to become an academically trained engineer. The only trouble about it is that it is not a truly living profession drawing out the highest, the noblest and the most beautiful in human nature. So I come to the conclusion that in young boys engineering even if it is suggested playfully is not an indication of an aesthetic nature, speaking generally. This division includes handicrafts like carpentry, joinery, etc., because it is very likely that many young boys who have put down engineering are imagining only such

specialized branches and not the truly academic engineering. I do not wish to imply that every really good engineer must be an academic man—far from it. The only thing I mean is that just as the barrister qualification is the lowest test of mental ability so the academic engineering qualifications are the highest tests of mental ability. Here let me add that those who wanted to be barristers I have classed among cultural professions because though this training leads these students to be fault finders, always trying to find out hidden meanings that do not exist, yet all my barrister friends seem to be fond of literature and other cultural subjects and have a far higher intellect than their examination qualification indicate.

My suspicion about the want of genuineness shown in the preference for engineering is confirmed by the fact that as these boys grow up and understand what engineering requires of them their desire to be engineers steadily decreases.

The third important group is of those engaged in clerical occupation (that is, pertaining to office work and not to clergy). I looked upon the inclination for this occupation as made up mostly of sex inclinations of a romantic nature and not so much of a sexual nature.

Many boys and girls go to colleges preparing for clerical work because they like the idea of coming across " nice girls " and " fine boys ". After this there is the real romance as far as young ladies are concerned. Almost all of these hope to come across some desirable young man by going to office, if not the managers or owners of the firms, themselves. Besides this factor of sex romance there is partially the factor of playfulness. Some of these girls even if they are grown up to twenty enjoy the play of tapping on the typewriter. This is one of the

pleasures that is compounded of feeling and also the sense of being the conqueror. Every tap that is made gives first the pleasure of feeling and then the sense of being the victor over that letter which has given in to the force and will of the operator. Very few people would like to tap for any length of time on something that is immovable and offers resistance. Were it to offer positive resistance and not only negative, then not only would few like to tap at it but most would dislike it. The positive resistance in this case would be exemplified by having sharp pin points on these buttons. However, fortunately for us most of the children up to 21, who chose typing as the profession clearly put it down as typing. I classed these as the group of playful professions and so the clerical group is mostly indicative of sex romance, though there may be a trivial element of typing playfulness. The group of those inclined to playfulness includes typists, tram-conductors, etc. At first I thought of classifying tram and bus conductors into the group of motion lovers but by thinking of a friend of mine of my childhood days, I remembered that though he was never keen on running and other such sports, he wanted very much to be a conductor. The reason appeared to me to be the liking for clipping the tickets which is the same kind of pleasure as typing, but here there is more the sense of victory than in typing. To make sure of this and of several other things I got a hundred children to write an essay on what they would like to become and why. By studying these essays I found that I was right because some children plainly confessed that it was because they liked to clip tickets, that they wished to be conductors. But I was rather surprised when I found that some in addition to clipping tickets, gave collecting money as the reason. I was quite disappointed to find that an appreciable

number of children in selecting several professions, referred to getting good wages. To think that young children of seven, eight, nine, ten and eleven, show this greed for money is painful, though it is only a special form of the acquisitive instinct that was in the hearts of even the progenitors of man. However, when we come to find some relationship between colour preference and mentality it will be easier to follow them if the statements I make here are fully understood. So let me further explain that the pleasures like those of typing and clipping have these factors. We know that many people like to stroke dogs and other animals. People do not stroke them so often to please these animals but to please themselves. I have not seen anybody stroking the hard scales of a tortoise, or a turtle, or an alligator, though I have seen people keeping them as pets. The dog that has a soft coat is stroked more than one with an ordinary thin coat. If the thin coat is not smooth and pleasing to the touch, then this dog will be still less a favourite of strangers.

The pleasure in stroking in the case of a dog with a fur-like coat has not only to do with touch but also with victory over so much fur that gives way to the manual force. Any resistance to the victorious march of the hand on any surface is unpleasant and so we have the marbles and wood furniture made smooth.

Even in human beings we like rather to pet the head of a person with smooth and thin hair that pleases and gives in to our force, than the hair that is thick and not smooth. However much a woman may like a man she will not like to stroke his chin with two day's beard as much as the chin freshly shaven. This will sufficiently explain to thoughtful readers this point of the pleasure of touch and non-resistance.

The next group to consider is humane. This includes sick-

nursing and nursing children. This also includes kindness towards lower animals and missionary work. With regard to the missionary work I must explain that this seemed to be the only group in which I could class this solitary one case in about three thousand. This disinclination to be missionaries is indeed a very healthy sign in the English people because it shows that there is very little bigotry and ignorance about other religions. The two absolutely necessary qualities for an ordinary paid missionary are to be thoroughly ignorant of the beauties of other religions and also be a bigot about his own religion, otherwise he cannot possibly keep on pestering people out of time and out of place as he or she does in India. The other hopeful aspect of it is that when fewer missionaries are sent to India we will have taken a very helpful step in consolidating the Empire, if the money thus saved is used for education. The people of India are so religious by temperament that sending religious missionaries there is a thousand times more stupid than sending coals to Newcastle. We must make an honourable exception of the Salvation Army workers.

The gastronomic professions include working in sweet-shops or making eatables etc., which on the face of it is important especially in considering children. Those who want to become policemen etc. are grouped under "authoritative" because young children like the idea of being able to stop all traffic, and be the kings of it just the same as some of them have wished to become kings and queens. This group in the case of children includes those who want to be teachers. They like the idea of having authority to make children do what they like though some may have the pure desire to teach. The domestic group includes such work as of housewife and also such a wish as to be "an old maid" that one little girl of nine wanted to

become. It is very likely that she wants to emulate some good old maid very kind to her. Then comes the group of motion lovers or the non-stationary occupations. This indeed is very important—motion being one of the first and most important instinct in life phenomena. Those who like sports, out-door work like that of messengers, postmen, or want to become travellers, adventurers, explorers, aeronauts, motor drivers, etc. are placed in this group. Fortunately there were not many returns of foreign missionaries, otherwise they would have been classed in here, because one thing that is absolutely certain about this work is, that it is not by any means specialistically intellectual, or manual, or artistic. Some people who have no definite gift of these kinds but a great desire to travel in foreign lands, select foreign missionary work.

The results of these returns are very decisive from one point of view while very disappointing and more perplexing than those of age from some other points of view. The mentalities seem to be divisible on the whole into two types, the bluish and the reddish. The red-likers seem to be less matter-of-fact, and have less regard for personal safety than the blue-lovers, who seem to be more calculating, and less impressive, and less impulsive. The red-lovers though not indolent seem to be less fond of hard mental work and more of artistic work than the blue-lovers who seem to be wanting to conquer the world and go about it methodically. These remarks relate to returns up to the ages 21 and 22. After these the blue-lovers, especially among women, show a marked increase for artistic occupations. The female percentages for artistic occupations under 11 years are 26%, at 12, 24%, at 13–22, 34%, at 23-45, 34%, and at upwards of 45, 37%. Excepting the age of puberty which seems

to show such a sudden rise, there is a steady increase for artistic occupations of cultural groups with the increase of age in lovers of blue of both the sexes. For men under 13, 8%, at 14, 13%, at 15–22, 23%, at 23–45, 55%, and at upwards of 45, 48%. These compare unfavourably with lovers of red of both the sexes below puberty. Boys under 11 select 7% and at 14, 27%, of artistic occupations and girls 30% and 30%, respectively, which fall lower than those of blue as age increases.

Females liking yellow give a very bad report of their artistic tendencies, for below the age of puberty and at the age of 14, there is not a single girl selecting an artistic occupation. In boys under 13 years it gives a favourable percentage of 9% as compared with 5% of blue, giving only one case at the age of fourteen. In girls it gives 12% at the period between 13–21. In spite of these few tolerable appearances of cultural traits in yellow-lovers, taking everything as a whole, they are not artistic or the least of these colour groups not counting the black-likers. Yellow preference does not imply anything very definitely but seems to show an extraordinarily high percentage for humane professions. It also shows a noticeable desire for wealth. This may be because of the colours of gold being yellow and orange. For girls under eleven it gives 33% of humane professions as compared with 18% of red, 13% of blue, 7% of green and 16% of even pink. I said "even pink," because the majority of girls wanting to be red-cross or hospital nurses, are lovers of pink, but because of other humane occupations included in this yellow group pink gives a smaller percentage than yellow. The most disconcerting fact about this selection of the humane professions so high among yellow-likers is that this percentage is higher in those liking violet which is forty per cent under the age of eleven in

girls. Now if colour preference is to show any mental inclinations then we cannot very well expect the complementary colours such as yellow and violet both to point to the same tendencies so this result is annoying. Some day it may be proved by some other investigators to be a mistake. We shall consider this point further when we come to examine violet-likers. Yellow colour as the one best liked, gives so very few returns even though I included in it champagne, cream, etc., that it becomes difficult to say anything about its mental co-relation from statistics only.

Coming to green we find that it shows remarkable increase, with age, of the artistic tendencies in both men and women. The arts percentages for the first four groups of ages in females are 28%, 33%, 42% and 57%. After 45 years, my statistics say nothing. In males they are 10%, 10%, 4% and 42%. So here we do not have a steady rise but a decrease to 4%, between the ages of 15 to 22, and a very sudden rise to 42, from 23 to 45. The most remarkable thing about green is, that it gives an increasing percentage for clerical work in men. This rise seems to be somehow related to sexual tendencies. Before the age of puberty green-liking boys had only 9% preference for office work, but at the age of puberty, that is, 14, it became 80%. This hints once again at what we had seen even without this occupational preference. At this age, boys simply seem to be adoring girls, and hence they wish to take up this occupation, as in order to do so, they go to mixed colleges for boys and girls, from their boys' schools, and afterwards they hope to come across many a girl typist and girl clerk. This percentage, though not so abnormally large at the age period between 15 and 22, is still so high as 48% as compared with 24% for engineering and 4% only for the culture group. This high 48 per cent at this period can also be connected with sex force as the sex

ebullition is not quite settled yet. The 14% of lovers of green preferring clerical work at the period of 28 to 45 is again higher than of those liking other colour at the period. At this age the artistic inclinations increase enormously, as already said, to 42%. This can imply that green liking men between the earlier half of 23-45 have strong sexual instinct. This would mean that art is in some way related to sex. This is probable, but I do not like to reduce everything down to sex motives like Sigmund Freud, though we must enquire into that kind of relation. Many a young man who wishes to become a painter of human form is to a certain extent drawn to it by the charms of nude models. Nudity is not necessarily beauty. Yet young artists making the excuse that art has nothing else to do but to express beauty, choose to paint nude figures especially of women. If the law of a country would prevent the painting of nude forms I believe it will decrease the proportion of painters to a very significant extent. Nobody doubts that old artists are also great lovers of beauty and great exponents of it, yet we find that they do not paint nude forms to the same extent as young artists do. Again the fact that many a young artist's studio in London during the times of the Great War had turned into a night-club because night-clubs were stopped by law, throws some light on this matter. Even without the war, painters' studios have often been regarded as the nests of love-birds. Even prima facie it appears that an artist who is a lover of form is likely to be fond of nudity, and, being after all a man like other men, must get his desire inflamed. This is only about painting. It is pretty well known that in the stage arts, like acting etc. the sex fascination is great. Even for the sake of acting, to be kissing and to be kissed daily, before

thousands of onlookers, it is necessary not to be sexually too modest. I wish to make it clear that I do not suggest that all actors are more immoral than those in other professions, but all I say is, that there is an appreciable amount of sex fascination in this line of occupation. The art of ball-room dancing certainly has a sex fascination. I have often thought that it furnishes a very harmless way of letting sex energies escape. Thus the remarkable preference for clerk's work at the ages of 14 and between 15 and 22, and also strong inclinations to art then, does make me feel almost sure about the fact that green-likers have strong sexual impulses and they spontaneously attempt to cool them by choosing green. One lady of 46 expresses a wish to do private secretarial work. This may be as a private secretary of a woman, but in all probabilities it is the secretary of a man that she would like to become. I notice she is not married. Probably she likes to be in company of a man and by being his private secretary she may intimately get connected to him and be in his good graces without immoral intentions. The sex potentialities have died out at this age, yet the latent sex impulses are there, as in the case of a girl before puberty. I also find that several green-liking young ladies like to become private secretaries. One green-loving young man of 25, says that the thing he likes best to do is to entertain girls. It is remarkable that no man after the age of 45, in my returns, likes green, and only one woman of 46, does so. I must add that one must not go about in life trying to judge the character of people from any one point of view alone. The best thing is not to try to judge but to take people as one finds them, according to their actions.

Turning to violet I find from my tables that out of about

3,000 people violet-likers are inclined to be versatile or in other words, all-round clever, instead of being specialistically gifted. Let us examine why versatility can be called true all-round cleverness. Versatile people are those who can do many things well, though perhaps not one thing perfectly. Some people who are now-a-days over-charmed with the idea of becoming specialists, try to say that versatility is bad, because the only way of getting along in the world is to become a specialist. All those ways that enable people to get along well in the world are not necessarily ideally good. Some people also confuse those wandering brains who cannot do anything to a tolerable pitch of proficiency and jump about from one thing to another without getting recognition in any one, with those who pass on from one kind of work or study to another after having attained a certain level of proficiency and having created something new. Those who wish to be heads of institutes concerned with various subjects must be versatile people who, having studied or worked in science, can appreciate and understand the difficulties of scientific work as well as of art works. They are interested in poetry as much as in sewage disposal. Thus having appreciation for all, they can be the heads of institutions dealing in various subjects. What is the use of putting a qualified engineer at the head of an institution that also teaches law and medicine, or a specialising theologician, as the head of a college that teaches also physics? A man who is a first-class engineer and nothing else when he is young, will be only a fool when he is too old to do hard engineering work. So versatility, which is so much discredited by people now-a-days, is very necessary in those cases where people have a chance of being heads of institutions, so that they do not in a hurry depreciate any kind of work. Thus violet-likers, being

versatile, should be also appreciative and kind, taking things a priori. I find that the highest percentage of humane professions under the age of puberty in girls is in violet-likers. It is 40%. And even after puberty in other groups of ages, it maintains percentages the sum total of which is higher than of any other colour likers. Even in men it has a comparatively higher percentage in the selection of humane professions. Again we find, that it has artistic inclinations that are surpassed only by green-likers. For the first four groups of ages, violet-likers give 28%, 33%, 25% and 20% of artistic professions among females. In the case of males, the culture percentages for violet-likers are higher than for green-likers. The green-likers give 10%, 10%, 4% and 42%. The violet-likers give 15%, 22%, 15%, but none between the ages of 23 to 45. The most striking fact about male violet-likers is that not one of any age group has chosen to be a clerk. Not one male violet-liker wants to be a clerk. This shows that they are rather ambitious people and therefore not easily satisfied. Again we find that they give highest percentages for non-stationary occupation. Blue gives the next highest. The male violet-likers for the three age groups give 30%, 33%, and 30% as compared to 20%, 30%, and 20% in male blue-likers for non-stationary occupations. In green-likers these percentages are 20%, 10%, and 16%. It seems that violet-likers being very ambitious and fond of motion spontaneously choose violet to cool themselves. The desire for adventure and travelling seems to fall suddenly after about twenty-two in all colour-likers. Though clerkship is not liked at all by violet-liking males it gives 6%, 33% and 34%, in girls of the first three age groups as compared with 21%, 22%, and 18% of those of green-likers. Taking both sexes the green-likers give a much higher percentage for clerkship. It is worth

noticing that one young violet-liking lady between the ages 22 and 45, wants to be an explorer, a parallel of which is not found in connection with any other colour liker. Between the ages of 15 to 22, in boys, the preference is divided thus 22% culture (artistic), 23%, engineering, 30% motion, 15% playful, 10% domestic. This will show the versatility of the violet-liking temperament. The professional percentages of violet-liking girls between the ages 22-45, are 20% culture, 20% authoritative, 20% humane, 20% non-stationary, and 20% domestic. To cut the matter short, violet-likers are versatile, ambitious and active. Violet seems to be a cooler of nervous heat, while green is a cooler of sexual heat. This is the last of the five main colours—red, blue, yellow, green and violet—that we have considered.

Now we shall make a general survey of the results, of pink, black, white, grey and brown. Of these, pink is the favourite of girls, but in the case of boys, white competes with pink. Brown is longer lived than the rest in males because it alone has adherents in the age period between 23 and 45, though in the case of females, pink is as long-lived as brown.

The returns of preference for these colours were all scanty, but none so scanty as of black. Only one girl of 12, likes it best and she also choses reading as the best occupation. Black has more adherents among boys. Altogether only eight children under fourteen liked black and no grown-ups at all. So speaking roughly, there are about three in every thousand that like black the best. This is exceedingly, or almost incredibly, low, considering that for generations men have been forced by custom, to have dark, dull and dingy colours for their suits, black as the best colour for evening dress. Really these are the days of colour intolerance and tyranny of custom as far as men are concerned.

No wonder there are more colour-blinds in men than in women, and we can see some meaning in the surprise expressed by William Morris that considering how little volitional perception of colour we practice we are not blind. Only five females (upwards of 13) like grey which is more favoured among males. It is difficult to deduce any probable relation to mentality from such meagre statistics. It is surprising that white, with which we have been associating all that is pure and good, should be so little liked that it takes precedence only over black, grey and yellow, and not even over brown. If white shows anything it shows a wandering and not a sociable nature. It must be admitted that it shows very little preference for clerical work, and that the white-likers have not strong sex impulses, they are not capable of getting easily attached to people and things, or in other words, becoming sentimental. All these colours,—pink, black, white, grey and brown,—give very high percentages for non-stationary occupations. The liking for movement in these taken together is higher than that of the other colours considered. Pink is indicative of a mind fond of tidiness and humane work, and yet is not very emotional. To sum up the probable mental co-relations with colour preference from my investigation.

(1a) Red-likers are inclined to be mentally indolent and not scientific but are emotional and kind-hearted;

(1) Pink-likers are less indolent, fond of tidiness and humanitarian occupations, but cannot so easily be moved as red-likers;

(2) Blue-likers are mentally active and matter-of-fact and calculating though not unkind to others;

(3) Yellow-likers are lethargic and may be geniuses or eccentrics or idiots. They are inclined to be spiritual

but rather credulous, not, caring to trouble about investigations.

(4) Green-likers have strong sexual impulses and so probably are more jealous and less tolerant than others. They are most artistic. They are inclined to be indolent.

(5) Violet-likers are mentally and physically active, versatile and ambitious and so inclined to be discontented.

(6) White-likers are not sociable.

CHAPTER V

PSYCHIC COLOURS

Simultaneous Contrasts

The word psychic is not so very narrowly limited as some people think. Some use it only for ghost stories, some for ridiculous superstitions, some for spiritual philosophy, some for mental sciences and others for mental physiology. All these, when not indulged in credulously for mere sensational delight, but for finding something useful for the body, mind or soul of human beings, are worthy of that noble adjective—even the superstitious because they sometimes have some underlying truth or are indicative of some lines of philosophic research. When we consider the psycho-physiologic phenomena of colour, simultaneous contrasts and after-images seem to lie on the very edge of this subject and of psychology.

Speaking in very simple words the phenomenon of simultaneous contrasts is the experience of simultaneously perceiving the complementary colour or its effect around any object having some colour. Thus by looking sufficiently long on a red square on a grey or white background the surface round the red square will be tinged green or vice versa. On this study of simultaneous contrasts also I must once again state the results at which Edridge-Green has arrived as those that appear the best to me:—

(1) The colours seen by simultaneous contrasts are due to the exaggerated perception of a real, objective relative difference which exists in the light reflected from the two adjacent surfaces;

(2) A certain difference of wave-length is necessary before simultaneous contrast produces any effect. This varies with different colours;

(3) A change of intensity of the light of one colour may make evident a difference which is not perceptible when both colours are of the same luminosity;

(4) Simultaneous contrast may cause the appearance of a colour which is not perceptible without comparison;

(5) Both colours may be affected by simultaneous contrast, each colour appearing as if moved further from the other in the spectral range;

(6) Only one colour may be affected by simultaneous contrast as when a colour of low saturation is compared with white;

(7) When a false estimation of the saturation or hue of a colour is considered in relation to this false estimation, that is to say, the missing (or added) colour is deducted from (or added to) both;

(8) A complementary contrast colour does not appear in the absence of objective light of that colour;

(9) The negative after-image of contrasted colours are complementary to the colours seen.

With regard to this subject, my theory of colour vision works very well. When a person is looking at red colour, the cones attuned to red light are the most affected; however, as I have said before, the cones for yellow and blue perception are also a little excited because

(a) these cones are not separated by miles but are all very close together;

(b) though the evolution of colour discrimination has advanced far enough to bring about a comparative division of labour, yet has not broken the inter-relation between them so as to make them narrowly specialistic without any sympathetic excitation. We have the

sympathetic pain in the ear because of troubles in the throat and these organs are millions of times more distantly separated than the cones of the retina. Thus blue and yellow perceiving cones are sympathetically excited by the excitation of red ;

(c) the ordinary light under which we try these experiments naturally becomes to a certain extent analysed by every coloured object so that the object can take what it absorbs and throw away what it reflects. Unless it can separate these two complementary parts, it cannot absorb one part and reflect another. When it reflects it reflects not only what is the objective colour but also a little of what is its complementary which is not so perfectly absorbed as to take in all the cent percentage of the disintegrated complementary colour. This slightly diffused complementary colour when enough time is given can excite the cones of complementary perception ;

(d) the long practice of consciously discriminating the strongly preponderating reflected colour has brought about a mental automatism as it were to shut off the slight excitation of the complementary cones so we see that one colour alone in ordinary conditions ;

(e) under special conditions and when effort is made or time effect is strong enough or conditions are favourable, this subconscious automatism is overcome and also the slight excitation, be it sympathetic or be it actually objective, due to disintegrated light giving diffused presentation. Usually by both the eyes we see only one image because of the mental automatism

that is evolved by practice to fuse the two images into one.

Yet if we hold a finger vertically about a foot and a half from the nose and then bring it nearer the nose at a certain distance we perceive two fingers.

Thus by presenting things in unusual or rather unnatural conditions we bring about such conditions as confuse the subconscious mental automaton.

The simultaneous contrasts are to some extent of the nature of optical illusions by which we perplex the eyes by presenting unusual and sometimes unnatural combinations and then blame the matter-of-fact eye for being deceived.

Thus these blue and yellow perceiving cones that were slightly excited and because the over-ruling of the automatism was broken, these blue plus yellow excitations gave the greenish coloration round about the red object gazed at. Were the object violet it would objectively affect the red and blue perceiving cones preponderatingly, but the sympathetic excitation as comparatively subjective excitation due to the not completely absorbed but differentiated yellow caused by disintegration, will excite the yellow perceiving cones. Thus yellow will be subjectively perceived by volition through objective excitation. To work out these phenomena of complementary excitation for perceiving simultaneous contrasts I must here state my law of complementary colours propounded in my little book, "Colour and the Child," viz. 'the complementary colour to any one of the three primary pigments, is the product of combination of the other two primary pigments or vice versa.'

Here I may be allowed to divert, to explain the difficulties of the colour-blinds as that is connected with the explanation.

My notion is that the colour-blind people have a difficulty with red and green, because the excitation of both produces a perception which is not sharply discernible. How can this happen, let us see. If there is some trouble in the eye the excitation made by red may not be so preponderating as to superimpose itself on the excitation of the blue and yellow cones to such a degree as to make it very distinctive. The effect may be just strong enough not to be quite mixable with the blue and yellow effect. This may be due to the red perceptive mechanism being not sufficiently efficient to overcome the total effect of blue and yellow mechanism, which may be over-sensitive. Hence when red and green colours are separately presented to the colour-blind people they are confused but when presented side by side they see the difference. In the same way other difficulties can be explained but there may be some difficulties in which one must take into consideration the light and shade perceiving mechanism and also the fact that the colour perceiving centre in the brain may not be working efficiently or may not be sufficiently evolved.

After Images

Simultaneous contrast and after-image phenomena are both connected with the excitation of complementary colours, to the colours objectively perceived. The after-image of gazing long enough at a red square, produces the subjective perception of a green square on either shutting the eyes or by looking at a white, or some other suitable object. As far as the retinal action in after-image is concerned we can explain this change. While looking steadfastly at any objec twe bring about some physiological activity which seems to stop as soon as the cause of excitation stops, and then the re-action sets in to bring about the balance. I have experimented on

these actions and re-actions and I find that they are proportionate and opposite like other actions and re-actions. The longer the time of exposure of the retina to the objective excitation, the longer is the time of the subjective re-action. In other words the katabolic and anabolic changes are proportionate and opposite. Thus when red activities are excited by objective gazing then on shutting the eyes or removing the causes of excitation the green activities are set in to bring about the balance. So far so good, but both after-images and simultaneous contrasts have some causes farther back than the eyes. They are right inside the brain and its mysterious expression the mind. In Bain's "The Senses and the Intellect", it is shown that if we in our imagination gaze steadily at the image of red with sufficient concentration and for a sufficiently long time, on opening our eyes on white surface we can perceive a green tint. In this case the first presentation, if that can be so called, was subjective, while the after-image was comparatively objective. Speaking absolutely and not comparatively these actions and re-actions are subjective, but all that we ordinarily speak about is in comparative terms so it is safest to do so in this case also.

Wundt also showed that by long contemplation of the image of a colour a consecutive sensation of a complementary colour could be experienced. A still more interesting experiment is related by Monsieur Beclard, thus—"The impression of a colour upon the retina, awakens on the same point on the other retina, the sensation of the complementary colour. Shut one eye, gaze for a long time with the open eye at a red circle; then shut this eye, open the one which was shut, and you will see a green aureole appearing." With regard to simultaneous contrasts, M. Pirinaud showed that when he produced in his patients under hypnotic sleep a hallu-

cination of red on one-half of a white sheet, the patient saw the complementary green on the other half without any suggestion. This can be a case of truly psychic simultaneous contrast. Yet there is one thought that arises in my mind that makes this result of dubious value. Perhaps the hypnotised subject was telepathic, and the thought of M. Pirinaud about the other half appearing complementary might have influenced the subject. However as there are other cases of after image of a similar kind it is not necessary to bring in telepathy to make this possible. Alfred Binet describes his experiment in the following words. "Bar in the waking state is achromatopic in her right eye. Keeping her left eye closed, we make her see a flock of birds. To our questions on the colour of their plumage, she replies that they are all white or grey. If we insist assuring her that she is mistaken, she maintains that she sees only white or grey birds. But the state of affairs alters if at that moment we open her left eye, whether her right eye be closed or not; she is immediately enraptured with the variety and brilliance of their plumage, in which all the different colours are combined. This experiment has been varied in many ways." This experiment at first sight may appear to work against the idea of colour perception or colour-blindness having anything to do with the brain centre because with a colour-blind eye, even in a hypnotic sleep one cannot make a person see colours as if an eye was the only important matter. On further consideration one sees that this helps the idea of colour-blindness having a very definite relation with the brain centre. If the fact is that that part of the brain centre, that controlled the totally colour-blind eye, was diseased, even in a hypnotic sleep when the eyes are not doing their conscious functions, no colour impression can be made. Under

hypnotic sleep the subject with open eyes can be made to look upon a chair as a dog, because the eyes are not, really speaking, functioning. Whatever is perceived, is perceived mentally. Then, as the eyes do not matter, even the disease of colour-blindness in the eye would not interfere with the production of a colour hallucination. But as the brain colour centre is diseased, no colour hallucination can be produced in the hypnotic sleep. Monsieur Binet is also of the same opinion, and says that this can be explained if we consider achromatopsia as a cerebral phenomenon, as a functional disturbance of the cells of the cortex affected by the sensation of colours. Hence this functional disturbance places the same disturbance obstacle in the way of hallucination as in that of the sensation of a given colour. It seems probable that the sensation and the image employ the same kind of nervous elements. In other words, the hallucination would take place in the centres where sense impressions are received; it would result from an excitation of the sensory centres. What is said of the hallucination applies directly to the image.

It was Monsieur Richer who first observed that if only the achromatopic eye of a hypnotized subject was kept open, it was impossible to suggest any coloured hallucinations to her by the medium of that eye. If the patient had lost the colour violet, it was impossible to make violet enter into her hallucinations and so on. He says "It is rational to admit that the retina has an exact representation of itself in the cerebral visual centre. There exists a sort of cerebral retina, each point of which is in intimate connection with corresponding points of the peripherial retina." May I add that if we keep on having retinas behind retinas, why not might we have noses behind noses, and ears behind ears, and every organ its replica? In this way we can reach infinity, before we are

aware of it. There is no more a necessity for imagining another retina when we now know from experimental evidence that there is a colour-perceptive centre in the brain. Anyhow, M. Richer had come to the same conclusion as modern investigators have come to, that is, he believed as we do that there is something farther back than the retina that has some very important part to play in colour perception, be it objective, be it subjective, like that of the simultaneous contrast, or of after-images.

One of the differences between the consecutive image and the real image is, that the consecutive image becomes larger when a screen on which it is projected is taken further away, and it becomes smaller when the screen is brought nearer. A real image painted on a screen behaves quite contrarily.

It sometimes appears to me that besides the renewed excitation of an after-image, there can be an after-image of the after-image, so to speak the after-after-image. It would be slightly difficult to divide sharply the reviviscence of after-image and this phenomenon of after-after-image. If we look at a gas lamp for just a sufficient time and then with open eyes look into a dark space we see a purple after-image. Now if we shut the eyes we see a greenish after-after-image. The gas-lamp I have experimented with, gives very yellowish light and so the after-image is distinctly purple which some may even call violet. After a little while it turns reddish. When I shut the eyes at the right moment the after-after-image appears, which is green. I find this a little different from the results of other experiments I have done on the reviviscence of after-image.

Control of After-image

It was accidentally that I was first charmed by the beauty of the after-image of an electric lamp. I happened carelessly to gaze at a lamp on the station platform. The train entered the tube, and I looked in

the dark and saw an after-image. When it died away, I shut my eyes trying to think of it and by doing so I revived it. Then I became absent-minded and yet it remained a beautiful diamond-shaped crystal of the most brilliant ruby imaginable. I saw it outside of me at about a distance of three feet. This brought me back to my thoughts about it. I kept on repeating the experiment from station to station and absent-mindedly passed my station. I found that by a strong effort of the will to revive the dead image I could bring it back quite three times easily, that is to say, after about six efforts. When I happened to look at the lamp filament for just sufficient time and shut the eyes, once to my surprise I got an after-image that was of yellow lines on black back-ground. This was only for a second. The filament image became brilliant green. Then it became more green and fused in one oblong green nebulous mass. This slowly got a pink fringe which kept on increasing and spread over the whole green and so the whole looked pink. This slowly deepened and then a green fringe came round it. This red diamond or ruby with a light green frame remained for a long time, and then either died away or escaped by moving away at one of the eye corners. On making an effort I either revived it, or as it were pulled it back by the ear before it slipped out. The luminosity did not change much when I succeeded in pulling it back, but when I could not do so and revived it the luminosity had decreased. Every time I succeeded in reviving it, it showed less red but increasing green which also became very deep. After the stage of luminous emerald it became very dark green and then dull dark green. In three experiments only, I could get a black tiny spot on grey background by very strong volition after the dullest green image had died away. After that evening I went to a suitable room

having electric light, and experimented more systematically, thus—

(1) First I exposed my eyes to the lamp for a definite period, timed by a stop-watch.

(2) Then on shutting the eyes I watched the after-image, and as it died away or glided out, I revived it and took a note of the number of times I could revive it.

(3) I also noted the total length of time over which I could revive the after-images from the time I shut the eye and switched off the light.

(4) In one column I put down the colour changes.

The exposures were of 5 seconds, 10 seconds, 15 seconds, 20 seconds, 25 seconds, and 30 seconds. Each exposure was repeated five times. The results of 30 seconds were very uncertain and I could not note more than three results as my eyes were too tired. The averages of the total time of after-image re action for different exposures came to be—

The time of exposure of the eye in seconds	The total time of after-image reactions in minutes and seconds
5 seconds	1 minute 30 seconds
10 seconds	2 minutes 40 seconds
15 seconds	2 minutes 56 seconds
20 seconds	3 minutes 8 seconds
25 seconds	3 minutes 30 seconds

These results, which are the averages of results, show that with increased exposure one can increase the total time over which the after-images can be revived. This increase does not vary in direct proportion but the increase at each higher stage of exposure decreases as would naturally be expected. The results especially the last ones are not even because it was a difficult

matter to know which was the last time the image could be attempted to be revived or not. After the last image died out I was still endeavouring to revive it and I did not know whether it would be revived or not, and so I had to make an approximate guess so that the time of each effort would be the same. Otherwise the results are quite reliable within measurable possibilities.

The number of after-images that could be revived is not so clearly indicative yet it will appear from the average results that the possibility of reviving was increased with increased exposure.

The time of exposure.	The number of reviviscences.
5 secs.	6 after-images
10 secs.	6 „ „
15 secs.	9 „ „
20 secs.	9 „ „
25 secs.	12 „ „

These results are not satisfactory and not reliable for any other purpose than to show that the possibilities of reviving the after-image are greater with greater exposure. These are likely to be individualistic because they depend to a certain extent on the power of volition. It seems to me that this power also increases a little with practice. The first time I tried I got only three after-images by about six efforts. The maximum number of reviviscences that I have been able to attain is 13 at an exposure of 25 seconds and a duration of 3 minutes and 35 seconds.

Colours of After-images

Of the colours of the after-image in the experiment in which I was able to get six images, the first one was of very bright light green,—then the three following were bright red and the last two were dull green. The second reading had (1) lemon green, (2) green, (3) green

with a red fringe, (4) ruby red, (5) dark green and (6) dull green. By the second exposure of ten seconds the second after-image produced was of yellow filament on rose ground. Thus to have a positive after-image as the second revived image was very surprising. By the second exposure of 20 seconds the sixth after-image became almost black on light grey background. *After the fifth exposure of 20 seconds I saw beautiful pure blue in the after-image. This was a novel experience but was very pleasing because it proved to me that by this long exposure of twenty seconds made the fifth time, I had bleached most of the purple and the yellow with the result that blue had a chance of becoming conspicuous. This supports my theory of colour vision being based on three primary sensations—red, yellow and blue. We have actually found red and yellow but blue is the colour that was to be proved.* This blue was very transient. The after-images were comparatively much quicker in re-appearing. I continued to experiment with a larger exposure of 25 seconds and succeeded in getting distinct violet. The red that did appear was not such a brilliant and deep red but very light pink that was almost white. When this weak pink spread over the blue, starting from the fringe the whole showed a clear violet, but this was also very transient. Not only was red practically all bleached but the most remarkable thing was that green had disappeared. After this exposure of 25 seconds I thought it better to give a rest of five minutes to my eyes, after which I resumed with an exposure of 30 seconds. The first time I got twelve images in about 4 minutes or the volitional oscillation was of about 20 seconds each. But the most important result was that though I had exposed the eyes for a longer time than the last exposure the green colour re-appeared in the after-image. This shows that it was not the

only one exposure of 25 seconds that had got rid of green, but that was done by the continuous experimentation that had been going on but which was broken in the last experiment by the little rest I took. The third exposure of 30 seconds gave 10 after-images in two minutes and 45 seconds, giving only 16.5 seconds for oscillation. These results will show that neither the time of oscillation nor the order of the colours that change in one after-image are always the same. These results are from only twenty-seven exposures. By merely reading these observations one may not be able to see the factors of volition and expectancy but if she or he tries these simple experiments then the statements will be better understood. The effect of volition on after-image is not only with regard to the number of times they can be revived as I have shown but also with regard to the shape and to some extent the colour. Prof. George T. Ladd says that by attentively willing for perhaps three to five minutes, he caused a cross, or a circle, or two concentric circles or some other simple figure to appear in the retinal field. Speaking about Miss S's experience after ten minutes concentration he says: "Then at least one particular form of a cross could be got, at will, in all the principal colours except red. The violet and purple were however easiest to obtain. An intensely bright but not a dark blue could always be got; the green, on the contrary, was always dull, and the yellow and orange imperfect and tinged with brown." The reader will remember that in my case of the revivals of the after-images red, purple and green were the easiest but blue and violet the most difficult. This may be due to the difference in the original objective sources of light and to an appreciable extent to the difference in the nature of the experiments. In the case of one Mr. B———r the effect of fatigue is to make the cross persistent in the retinal field; and

this effect is sometimes so marked that he is obliged to open his eyes in order to dispel it. In these experiments the colours of the cross are apt to run through the order of red, orange, yellow, green and blue. In the case of another man the eyes get in a condition of strain and the result of fatigue with him is to make the images grow fainter and fainter. Prof. Ladd from these experiments concludes: "We have here an experimental demonstration of the unique and inexplicable power of the volition of the ego to induce changes in the cerebral centres and the connected organs of sense —and in this case, apparently without any use of the muscular system to control the nature of those changes." May I add that these experiments, being very entertaining, may be done by most people with the benefit of developing their concentration and volition. If not all, most psychic progress is dependent on these two powers—concentration and volition. However, I do not advise people to gaze often or too long at bright electric lights as I did, because it must do some harm to the eyes Gazing at small articles brilliantly coloured and then getting the after-image will be helpful in practising concentration and volition without the disadvantages of a bright light. However, to start with about six exposures of five seconds each with electric filament lamps will afford some guidance and encouragement. This volitional method of producing after-images of the shape one *likes is evidently* a form of volitional visualization. This power of *visualization can be* so very intense that one can see much more *complex forms.* Francis Galton in his "Inquiries into Human *Faculty* and its Development" says: "Mr. Flinders Petrie informs me that he habitually works out sums by aid of an imaginary sliding rule, which he sets in the desired way and reads off mentally. He does not usually visualise the whole rule, but only that part of it with

which he is at the moment concerned." Every engineer will envy Mr. Petrie for this wonderfully handy power of visualization.

Colour Imagery

Prof. A. C. Armstrong, who experimented with the Americans, reports that no less than 91% of the whole number think that their colour imagery is relatively distinct and natural, while only 9% fail in this respect. Some of the former go so far as to state that colours are much more distinct than the general outline and a few in the latter division are able to bring out the missing quality by turning their attention towards it. There is a higher development of the faculty of imagery in girls than among boys. There are quite a few qualities in which women are superior to men, because the orthodox way of living that is in touch with the realities of life instead of wasting time in political delusions or other manly pursuits, and likewise freedom from harmful manly habits had protected them from being tainted with the weaknesses of men. Alas, those days of truly gentle ladies are almost past, and we have men-natured women who cut their hair short, smoke like chimneys, wear trousers and fight like men for political delusions, neglect the noble duties of divine motherhood, lose the worshipful regard for parenthood by false notions of independence, and destroy the charms of true gentle womanhood. This extreme is as bad as the secluded, almost useless, life of ignorance of most Mohamedan women. However, reverting to the subject of colours of simultaneous contrast of after-image and visualization, I must add that the direct and transferred consecutive after-images or the after-image and the after-after image do not always have the same characteristics as must have been noticed from what I have said. On this point Alfred Bivet says "I have found that there is a fairly decided difference of tint for certain colours.

For example an orange coloured water gives me a consecutive image which is almost blue when seen directly, and almost green when it is transferred." With regard to the reappearance of after-images after a very long time the same author says: "This reviviscence of the long-expired consecutive image a long time after excitation sensation has ceased to act, completely excludes the idea that the consecutive image is preserved in the retina; the preservation is made in the brain, and very probably when the image reappears, it does not involve the cones and rods of the retina in fresh activity." A scientist who had spent a few days looking through microscopes found that one evening, soon afterwards when he was looking at a friend, a kind of after-image of the view of the object seen in the microscope super-imposed itself on the face of the friend and on other things he looked at. I believe I have said enough to show that colour is not a physical superficiality but is deep-rooted in our brain and mind. Moreover the deep-rootedness of colour can be yet more clearly shown by a consideration of colour-hearing.

Colour-Hearing

Colour-hearing in simple words is the phenomenon of seeing colours evoked by hearing words or letters or even numbers. This is actually seeing the colours and not having mere associations as I have. I cannot think of a few letters without at the same time thinking of certain colours. For instance, M always is associated with pink, C and F with white, and D with black. I can understand the probable causes of some of these associations. C perhaps reminds me of white, because it is the first letter of chalk which is white. F is white because it is the first letter of "foam" which is white. Perhaps in my childhood the teacher writing the letter C on a board with a piece of chalk produced the connected impression C—chalk—whiteness.

D is black perhaps because D, the initial of darkness, reminds me of black. However, why M is pink I cannot understand any more than why kindness, love and motherhood all are pink. Further, nothing seems to be so concretely associated as the number nine and the colour deep red-orange. Every nine is a certain deep orange of a definite hue that is very precise even in the degree of brightness. It may be be that the number nine was for the first time realised by me through some object which was the ninth as I was taught to count and was also of that particular shade of deep red-orange colour. However, I am a little surprised when I find that Baron von Osten Sacken had coloured numerals and that his nine was somewhat the same as mine. He could actually see the colours while I cannot help associating nine with that colour. But worse than all this is that nine is a little sour in taste to me. This idiosyncrasy annoys me because both orange and sour are colour and taste that I dislike while nine is my favourite number. Sacken had the numeral 1 black, 2 yellow, 3 pale-brick, 4 red, 5 blackish grey, 6 reddish-brown, 7 green, 8 bluish, 9 reddish-brown somewhat like six. I may add that my nine when I look upon it from the artistic point of view is indeed a beautiful pure colour without any dullness, but almost of the luminosity of a topaz. Further on investigating more on this point, I find that in other people vowel sounds evoke the colour associations while in my case vowels have nothing to do with it. This may be because my association is an exceedingly poor one. This is very realistic in some cases in which persons so gifted actually see letters each garbed in a different colour, when they hear it spoken. This gift is often inherited but the peculiar fact is that the colour of a certain letter in the case of a progeny is not the same as in the case of the

parent. One Mrs. H. of Galton speaks of her colour associations being different from those of her daughter. Most investigators have found that this tendency of colour association is hereditary though the sensations in parents and children are different. This difference in sensation gives the wonderful fact that in almost all cases the associations are different. This faculty has the tendency to become less and less distinct in most cases with the increase of age especially if it is neglected or repressed by relatives, to whom it may appear only a joke of a child. Such phenomena are known by the names "associated sensation," "secondary sensation," "synaesthesia," and "colour-hearing." Most of us have associated sensations of some kind or other, but most often about sound. When a slate-pen scratches on a slate, the noise that is produced usually causes a shiver as if a piece of ice was dropped down the neck by a mischievous school-boy. Some people complain that their hair stands erect on hearing certain sounds. I feel very uncomfortable when some one rubs two sheets of dry paper together. Ch. Flournoy in "Les Phenomènes de Synopsie (audition colorée)" suggests that "If the word synaesthesia (synesthésie) denote well enough any association of different sensations, then synopsia (synopsie) would include such as rest on a visual basis. Cases of synopsia are divided in turn into: photisms, when a colour is associated with a sound; schemata and diagrams (schèmest et diagrames) when the phenomenon takes the form of a spatial representation realized at once or developing itself in series; personification, where the figures, etc., are represented in the form of persons. He has arrived at the following results which he calls the laws of brightness of vowels :—

(1) i and e—bright in a majority of cases.

(2) u and ou—dark in a majority of cases.

(3) a and o—medium, fluctuating between bright and dark.

His law of the brightness of diphthongs is

(1) Juxtaposition of colours:

O yellow, A black, I red, OI gives yellow and red.

(2) Optical mixing of colours:

A red, I blue, E white, AI gives violet.

(3) Adoption of one of the component colours:

AI white, from I red and A white.

His reviewer in the "Psychological Review" says, "Flournoy distinguishes two kinds of schemata; the diagram, which unfolds itself in space, interpreting the sensations of changes experienced successively on reviewing a series; and the symbol, which interprets rather the entire impression of a single thing. As in the case of photisms first in the series we find localized and almost objective diagrams, which impose themselves upon the subject; and farthest removed from them, on the other hand, are the logical diagrams plastic modified by the possessor in conformity to his memory, or for fixing dates, abstract, ideas, the figures in a calculation etc. These are real aids."

Mr. George E. Thorp wrote a long article in the "Edinburgh Medical Journal" from which I have made the following extract, which has some bold statements and original thoughts. Speaking about his own experience he says, "I have found by experience that tone and colour are coalescent—that is, they are produced simultaneously by the same agent, they are inseparable, and also have equal prominence. Therefore colour audition is not the mere association of the idea of colour with tone, but an actual sensation. The union is so complete that the slightest change in one is always attended by an equal change in the other.

"After studying for months, I first noticed that it was the

slight movements of the base of the tongue, when singing the scale which produced these changes in quality, colour, and form of the tone. Moreover, certain movements of the tongue had the effect of projecting the tones from the mouth, while others seemed to detain them in the throat and impart to them a peculiar throaty quality. In singing words the tongue moved from base to tip, and on this account the same words sometimes had several colours, qualities and forms. Thus in "holy" the "ho" used to be hollow in sound and dark brown in colour; when the tone is more intense, the colour is red. The law governing change of colour I have observed to be the same as for change in quality, viz. the change depends upon the number, order, and relative loudness of the upper paritals in the tone."

Colour-hearing among the Blind

This synopsia is more common among the blind than the people with sight. This looks like a contradiction in terms. Yet as these colours can be seen with closed eyes also the blind are not cut off from it. Dr. W. S. Colman investigated this type of colour-hearing amongst the blind and found that at the most 12% possessed this faculty. One boy of 17, blind from the age of 13, always saw the following colours when vowels were pronounced thus:—

Ah excited light blue;
Eh „ pink;
Ee „ green;
Oh „ white;
Co „ light blue (with a metallic sheen on the surface). But no colour was excited by musical notes.

He records a case of 20, blind since 5 years old, having the following associations with the sound of musical notes:—

C - blue; D - navy blue; E - bright yellow; F - brown;

G - green ; A - white ; B - black. Thus if a piece of music were written in E as the key-note he would experience a sensation of yellow all the time it was being played. The brightness of musical notes was altered according as it was played in a higher or lower octave ; but each note preserved its own colour, E and E sharp giving rise always to a yellow photism. Speaking about a linguist, Dr. Colman says, " English conversation excited a grey colour sensation of the same sound as that produced by the vowel sound eh (a). German was black corresponding to "ah" ; Italian yellow, corresponding to ee ; and so on." He describes the following four types of photism :—

(1) In most cases the photism is not projected outside the body, but is referred to the back of the eyes or the inside of the head ;

(2) In others, there is an apparent background of colour behind all actual objects in the field of vision, not obscuring the view at all ;

(3) In others, the colours appear to correspond with the site of origin of the sound, such as the mouth of a person speaking, the strings of a guitar, the slits in an organ pipe, etc. ;

(4) In other cases the photism is projected into the visual field and may obscure objects or its colour may blend with that of actual objects to produce another.

All sorts of explanations are offered about the causation of these phenomena, including such miracles as that the centres of colour and of hearing were very near together or became abnormally connected. On this wrong theory that there was an abnormal anatomical connection between the lower centres for the reception of sensory impulses from the end organs, making it so to speak, a physiological rather than a psychological phenomenon

Dr. Colman says, "Against this may be urged

(1) That only a few sounds produce these colour sensations —colour sensations can be equally well evoked by thinking of the symbols of a sound, such as the alphabetical letters or the numerals;

(2) That there is an absence of any harmonious resemblance between the auditory stimulus and the induced visual sensation. It will be observed that there is no connection between the wave length of the notes and that of their corresponding photism."

This faculty of visualising colours and images spontaneously and volitionally has been often looked upon by ignoramuses as signs of insanity. We all know that the insane have hallucinations but that does not prove or even show that those who have the faculty of visualisation are necessarily insane. Only the thoughtless jump to such unsubstantiated conclusions. It is possible for a man to have rheumatism and be insane. In the same way a man who has become insane might have had this faculty. If hallucinations are accompanied by other symptoms as are of the insane type, then it may be pardonable to call a person insane, but because a person has photism or visualising faculty to call him insane would show a lack of judgment in the person making such allegations. This is as bad as those thoroughly ignorant and vehemently prejudiced people who spread the stupid and groundless notions that only the weak-minded people can be hypnotised and thus interfere unscrupulously in the good work that can be done in healing certain ailments, breaking many habits and producing anaesthesia for doing minor surgical operations by hypnosis. About this phenomenon of synopsia, Dr. Colman says, "It may be said first of all, concerning the nature of the phenomena, that they are not to be looked on as symptoms of a morbid brain condition."

Careful inquiries by Blenler, Lehmann, and Flournoy and my own more limited observations, agree in showing that "this faculty has no association whatever with mental disease or even with a neurotic heredity." Francis Galton made investigations concerning this faculty and also in visualising images. The people he examined were sound heads some of them being the Fellows of the Royal Society of London. He says about these people, "Those of whom I speak were sane and healthy but were subject notwithstanding to visual presentations for which they could not account, and which in a few cases reached the level of hallucinations. The number of sane persons who see visions distinctly is much greater than I had any idea of when I began this inquiry. Many men and a yet larger number of women and many boys and girls, declared that they habitually saw mental imagery, and that it was perfectly distinct to them and full of colours. The highest minds are those in which the faculty of seeing the pictures is not lost, but subordinated, and is ready for use on suitable occasions." I hope these words from Galton will carry sufficient weight and contradict the false rumours spread by romance-writers and scare-mongers. Yet let me give just a few cases of well-known people who had these faculties. Mrs. Hawers, the authoress, experienced and visualised pictures with words. Rev. George Henslow and Goethe also saw very vivid images in darkness. Napoleon the Great used to see a star about which he said, "It has never abandoned me, I see it on all great occasions." The brother of Mussbaumer was able to distinguish the colours of eleven overtones when a low note was sounded. Sir Galton often saw designs when looking in the dark and of them he says, "A kaleidoscopic change of patterns and forms is continually going on, but they are too fugitive and

elaborate for me to draw with any approach to truth." I should like to add here that this experience is a little different from those of hallucinations or synopsia. I am inclined to say so because I have experienced it myself. These tapestries of beautiful patterns, more beautiful and more varied in shape than those of the ice crystals and more gorgeous in colour than any designs and patterns I have ever seen, leave far behind those of William Morris. I find, the same as Galton, that they are too intricate and beautiful to be drawn and one tapestry remains before the eye just sufficiently long to be admired before it changes into another. Galton saw these by looking into the darkness, I saw them by putting my head under the bedclothing on waking up in the morning and keeping the eyes shut.

Imitative Coloration

It seems to me that as certain letters had certain associations of colours by the repetition of such letters flashes of colours can be produced powerfully in those people who have the faculty of synopsia and some *fair* imitation of coloration in a good number of people who are fond of poetry. In poetry we have the imitative harmony producing a suggestion of certain sounds. So I call this idea of mine imitative coloration. The letter "r" is very suggestive to poetic minds of rumbling, rolling, roaring and other noises. This, used with other letters of alliteration, may give imitative harmony of an army marching or charging. Thus in the third canto on ancient Zoroastrian Persia of my book "Romance of Souls," I have tried an imitative harmony when writing about the triumphant entry of Artaxerxes into the gates of Persepolis (if there be any harmony in the noise of ancient chariots and rough riders), thus, "Roaring rows of riders rough are rushing in

"Chasing chariots chaffingly are charging in

"Sinewed soldiers sing sonorous or shout
....."

But it appeared to me that while doing so I also had imitative coloration, hence in the fifth canto on mediaeval Venice in giving a pen-picture of the pageant of the Feast of the Maries, I used this imitative coloration to bring some flashes of suggested colours thus,

"The frocks of fashion fully filled with frills,
"Smooth silks and shiny satins sewn with skill
"Adorned in ornaments assailed by art,
"The blissful brides their burdens beautifully bear,
"The married men in measures magnificent made
"With manly mien and mirthful minds merrily march;
"Relations and ranks in raiment rich rejoice,
"The cheerful churchmen charily chant their choice;
"The Doge and dignitaries of distinction drive
"In chaises that chain to the channel from the church,
"Putting down princely passengers at parting piers.
"The handsome horses, the harmony of hues enhance,
"In costly coverings of colours they prance.
"The quiet and curious colours of clothes create
"Emblazoning effects that th' excitement elate.
"Fine flags with figures and forms flutter and fly.
"In gorgeous grandeur and gaiety grand
"Of pageant pompous of parents proud and pairs
"Of people pleased to partake in the procession."

This figure of imitative coloration I have used on several occasions in this book "Romance of Souls." Two infallible critics passed the triumphant verdict that this was bad English, as if I was striving at prosaic composition instead of getting

a definite effect by the use of the lifeless medium of hard-cut words. Perhaps they were tongue-tied or carried away by the misprints of the printers. May I take this opportunity to add that besides imitative coloration there can be imitative formation which I have used in the poem on "Progress" in my book "Rationalistic and other Poems." At least one critic who is a first-rate poet, Mr. J. C. Squire, was able to understand it and appreciate it. Thus those faculties of visualising forms and colours can be used in literature and can help in increasing these faculties. It is decidedly desirable to develop as many mental faculties as possible. Strength comes in being able to do something provided a person is the master of the ability to do it, and not the slave.

Some Experiments to find the Hearing of Colours among the Blind

The colour-hearing among the blind has been already referred to but now we come to the actual hearing of colour. When I found that some people insisted on saying that colour existed for us only because we had eyes I wanted to find out whether we could realise colour in any other way. The first essential was to get rid of the eyes, and so I thought of the blind. I undertook to examine blind people, and with the permission of the heads of four blind institutions I examined all those who were born blind and had no notion of colour and not even the sensation of light. However, to understand or rather to see the difference in the ways of expression I examined in similar way a few blind people who had once the sensation of light. I thought the ear was the next best sense-organ for the realisation of colours. I selected silk handkerchiefs and ribbons of different colours. As long as I could obtain silk handkerchiefs of the same texture, I got them, but failing these I got ribbons. So there were only two textures. I

wanted to keep to only one material so that the difference of texture was not the cause of any imagined difference. I had silks of red, blue, yellow, violet, green, orange, white and black and so even if two different textures were to suggest any difference they could not suggest eight distinctions for eight colours. I kept all other factors the same by keeping to the same size and shape of all handkerchiefs and same shades of all colours. In order to make sure that electricity or animal magnetism had nothing to do with these impressions, I kept each piece separately in an envelope and covered in a thick piece of paper of a colour as near to that of the silk as possible. I always kept these envelopes together, and did not expose any one of the silks to more sun or atmosphere or my touch than the other.

I simply put these handkerchiefs one by one on the ears of the blind subjects examined, and asked them the following unsuggestive question, "What impression does this make?" Quite 50 per cent of the subjects answered by saying that it made some peculiar noise like the steaming of a kettle or the rolling of a hoop, etc. Some did not speak of hearing sounds caused by the silk but that the sounds outside were muffled and some said that they were exaggerated, which was an extraordinary paradox. These people I corrected and told them that I wanted to know what impression was made by the material put on the ears. Some spoke of sounds and others of feelings, such as warm or cold. The latter were also useful, however, and I told them that I wanted to know what they heard and not what they felt. Then some, on making an effort, were able to hear something in some colours and nothing at all in other colours. There were a few who heard nothing at all. Only five per cent were unable to hear anything in any colour. I call these colour-deaf blinds.

With regard to those who had the warm and cold feelings of colours, I was a little suspicious and so wanted to put them off the scent. I put a green handkerchief to the ear of one of these and asked, "Is this very warm or only warm?" The answer was, "No, sir, it is quite cold. Oh no, it is not warm." So without giving him any sign whatever that I was testing him, I gave a piece of red and asked, "Is this as cold as the last or colder?" and to my surprise the answer was, "It is warm, sir." I tried the same on others who felt warmth and cold and I found it impossible to deceive them. This was indeed a gratifying result, but the proportion of those who felt colour more than those who heard it more was smaller. The majority of these had both the sensations. To protect against an adverse criticism I may add that all these silks were spread on a table or a bunch and not handled except to lift each up and put it on the ears of the subject, and there was no possibility at all of any one getting warmed more than the other. Fortunately most silks, thus differentiated into warm and cold, were of the very same texture, the only difference being the colour. Blue, green, and violet silks where those that gave a cold sensation, and red and black gave a warm sensation. White and yellow were ineffective. Orange gave a sensation of warmth to some, but nothing to others. Green was felt to be cooler than blue and blue cooler than violet.

In getting their impressions about hearing the colours, I thought it best to get rid of the factor of that hissing sound that we all hear when we put a sea-shell or a finger in the ear. I asked them all to put one finger in one of their ears and cover the other ear with the palm of the hand, and carefully notice the sensation produced. I asked them to keep the finger in the same ear, put the silk handkerchief to the other ear, and press it there

with the palm of the hand. When they said they heard this or that I asked them to distinguish this sound from what they heard with the finger and the palm on the ears. Thus I took all the precautions I could to guard against the possibilities of impressions other than those caused actually by the colours themselves. Some had hearing sensations which were all of the same kind, but of higher or lower tone, or of quicker or slower vibrations, or of different musical notes, or of altogether different kinds. I will give just one example of each first. One young lady of twenty who had lost the sight when only five months old, had the following audible impressions by simply putting the different coloured silk handkerchiefs to her ears:—

White—no impression;
Black—a crackling noise;
Red— „ „ but fainter;
Blue— „ „ fainter still;
Yellow— „ „ „
Green— „ „ more distinct;
Violet—"Can't get much from it."
Orange—a periodic throbbing.

One young man of 27 years, born blind, heard from

Black—slow vibrations;
White—quick vibrations;
Red—a clicking sound less pleasant than black;
Green—clicking less distinct, slower and softer;
Yellow—the same as green;
Blue—quick vibration like "the buzzing of the base part of a violin";
Orange—decidedly quick vibrations of metallic character;

Violet—soft continuous rolling sound higher than orange sound.

One girl of 14, blind at three and very fond of going into the country, expressed the impressions as follows:

White—nothing;
Black—rumbling;
Blue—rough sea;
Red—shaking cart;
Green—kettle singing;
Orange—the sound of an aeroplane, but of a higher note;
Violet—the sound made by young rooks but more prolonged and softer;
Yellow—nothing.

One boy of 16, who lost his sight at 5, gave the following results:

White—nothing;
Black—a train whistle;
Red—a higher note than the last; near A of the sixth octave;
Yellow—nothing;
Green—rumbling sound of a distant train;
Orange—nothing;
Violet—a distant rumbling like that of thunder;
Blue—like D in the fifth octave.

This case appeared a little more interesting to me, and so I tried to get the effect of the mixing of complementary colours and got the following:

Blue plus orange—nothing;
Red plus green—nothing;
Yellow plus violet—nothing.

These results were very satisfactory, but unfortunately in other cases I got different results by mixing the complementary colours as will be seen in the following cases of a gentleman of 35 blind from the age of 2:

White—nothing;
Black—dead buzzing sound;
Red—a throbbing like the heart-beats but twice as quickly as ours, i.e. about 160 throbs per minute;
Yellow—steam with a whistling note of the 5th C;
Orange—nothing;
Violet—quicker throbbing than red;
Blue—ticking of a watch;
Green—ditto, but less quick than blue and keeps the same time as a watch, i.e. sixty ticks a minute, and cold sensation;
Red plus green—"A quick knocking like that of a motor cycle when it cannot get its power up;"
Yellow plus violet—nothing;
Orange plus blue—whistling and sifting of wind, a mixture of the 5th B and 6th C.

I may add that the majority agreed when I gave them the complementary coloured handkerchiefs that the result was either nothing or next to nothing, but very mixed and complex.

I thought that if I could get someone who could describe these sensations in terms that were such as the sighted might use I may be able to relate these in some way.

One gentleman of 32 who lost his sight at 25, I thought would do this. His results were

White—crackling noise;
Black—sound of a six-cylinder motor engine's deep throbbing;

Red—less throbbing but more feeling;
Yellow—deeper than that of black, but had much more vibration;
Violet—series of little knockings, a continuous beat, staccato, short and sharp—the nearest to the fifth A in pitch;
Green—very similar to violet but a little slower;
Orange—more distinct and clear and also fuller than green—but not so deep and full as red. It has lower pitch than yellow but of quicker beat;
Orange plus blue gave the same result as of black;
Red plus green do do do .

This result shows that the mixing of complementary colours gives the sensation of black. One before had a sensation of white as already seen. We know that by mixing complementary pigments we can get black or deep brown or grey colour, but by mixing complementary colour rays, we can get white or light grey. These two facts about the perception of colour by sight and hearing seem to agree only to perplex us more than before. This last gentleman has not helped me so much as I thought he could. Whatever was the exact sensation produced yet one point on which all except one agreed was that the results of all the three compounds of complementary colours were the same.

One young lady of eighteen, blind 18 months after birth, heard the same beating by the mixture of complementaries. Her results were:

White—nothing;
Black—breeze with a soft beat;
Red—musical note;
Blue—"lower musical note";
Green—tiny throbbing with the period of heart's beat.

Violet—sound of the sea, but very soft;

Yellow—periodic throbbing;

Orange—slower than red;

Blue plus orange
Yellow plus violet
Red plus green
} All give the same impression of a soft beat like black.

One young lady who is 35 and was born blind gave very good results. She was considered very clever in the school. I think her results were about the most reliable taken altogether. They were

White—periodic escape of steam;

Black—bubbles breaking and steam;

Red—telephone bell without the ring giving a hiss and a pop. It reminded her of blank quick typing but with a higher note;

Yellow—one heavy crack and two quick light ones repeated very quickly;

Blue—sound of water falling on fire every second from a leaking kettle;

Green—no sound but cool sensation which is cooler than of blue;

Violet—tap dripping continuously;

Orange—like Morse code telegraph, but not so rapid;

Black—"The feeling would get on my nerves and drive me mad."

I wanted to see if the binary colour showed any relation to the primary colours of which it was made. She by hearing gave the following results:

Violet—gave a louder sound than blue and was related to blue;

Red—was less pleasant than violet but was warmer;

Orange—was related to red but not so loud as red.

Her result about black agreed with those of most others, but the following case is an extraordinary exception. This girl of sixteen was born blind:

White—nothing;

Black—very pleasant but made the same feeling as of sour apples which she liked;

Red—hissing noise resembling fifth D;

Yellow—very low pitch G of the fourth octave;

Green—fourth octave B. This reminded her mostly of the country;

Violet—E of the sixth octave;

Orange—sixth B flat. Reminded her of Mendelsohn's "Spring Song" by a whole orchestra.

Her results were so surprising that I thought there might have been some pre-natal influence or strange hereditary traits. On asking the head mistress of the school, I found that her mother was very unhappy on account of her husband's drunkenness and had separated from him.

One young woman of thirty, born blind, gave some results which may prove of some use to other investigators and so I state them here.

White—nothing;

Black—low deep sound and continuous as on a string giving A of the third octave;

Red—E of the third octave;

Green—F do do;

Yellow—D of the second octave;

Blue—F do do;

Orange—two sounds as of red and yellow;
Violet—A flat of the fourth octave more continuous than others.

This lady was almost sure of the notes, but somewhat doubtful about the octaves. Her answer, on putting an orange handkerchief to her ears, that its sound was composed of the sounds of the third and the fifth handkerchiefs I gave her to put on her ears, simply stunned me with surprise and gave me one more clue from which to draw deductions.

However one boy of 18, blind at 3, removed all my doubts when after hearing these colours he volunteered to grade them in order of their pitch. He graded them in the order violet, blue, green, yellow, orange, red, black and white, violet giving the highest pitch. His other answers were:

White—nothing;
Black—slight sound sensation;
Red—deep rumbling (most pleasant of all);
Green—quicker rumbling and more pronounced;
Yellow—same noise of lower key and slow vibration;
Blue—rumbling;
Orange—tapping fairly quick not quite even;
Violet—highest and most difficult to hear.

When he first put these to his ears he did not hear anything from black and violet, but when he had heard the others he could hear the black and violet also.

Without multiplying any more examples, I will just give the conclusions at which I have arrived from over 1,000 replies of 95 blind people examined. Let me add that these inferences are not conclusive but indicative. Some are decisive and others only probable.

The decisive indicative conclusions are—

(1) The vibratory nature of colours even in pigments is perceptible to the ears of the blind;

(2) These colours give both pleasant and unpleasant sensations of sound, warmth and coolness to the ears of the blind;

(3) The colour white has no such perceptible vibrations and is ineffective;

(4) Yellow is ineffective and is not pleasant;

(5) Black is unpleasant because of too much effectiveness;

(6) There is an audible difference of tone and pitch in colours;

(7) Red is the most pleasant to the ears though some consider green and even black as most pleasant.

The probable indicative conclusions are—

(1) It may be possible to arrive at the musical notes represented by different colours by examining a few thousands of the most musical blind people who are not very much trained in music;

(2) Some binary colours have a more homogenous mixture of the vibrations of the primary colours as for instance violet, while others make such bad mixtures that even by hearing them the two primaries can be separated, as for instance in orange;

(3) By even putting together in close contact complementary coloured substances the total effect produced may be neutral;

(4) By putting an article of a certain colour to one ear in some cases the sensation of the complementary may be produced in the other ear and no perceptible sensation may be produced in the ear against which the article is put.

CHAPTER VI

THE COLOUR-SENSE

THE SIXTH AND OTHER SENSES*

Nearly all our earthly knowlèdge is got through the five senses of sight, hearing, smell and taste with the help of our brain. Every time a man shows some uncommon ability that we cannot explain away by these five senses we hasten to attribute it to the possession of the sixth sense, that is, some one more sense than the five senses that we know of.

Most often the ability to forecast future makes people guess that the foreteller has the sixth sense which is also called the second sight. Some people habitually get dreams that prognosticate future. Such people are said to have the sixth sense. Similarly those who are clairvoyant or clairaudiant and can see or hear visions or messages that make them forecast coming event they also are believed to have the sixth sense. Some have mediumistic gifts and when in trance, and at times without being in trance, they see visions, hear messages and get into psychic contact with entities which are not physical beings, that makes it possible for them to forecast future. Thus, more exactly, they have three such senses. If a person is a dreamer of future events, is clairvoyant, and is clairaudiant, he has the sixth, the seventh and the eighth senses.

The possibility of a person having one or more of these psychic abilities or senses is no more to be doubted by those who have not such abilities than a deaf and blind person to doubt that there can be people who can hear and see. Just try to imagine how difficult or impossible it must be for a person born blind to

* This is the resumé of a speech delivered by Dr. Peshotan Sohrabji Dubash, M.A., D.Sc., M.R.San.I. (Lond.), etc., at the Karachi Rotary Club Dinner Meeting at Freemasons' Hall in 1941.

realize what it is to see. Thus there can be supernatural senses that some people have which are not patent in all of us but which in most probabilities are latent in all in varying degrees.

Colour-Sense

If there are several such psychic senses which of these can be justifiably called the sixth sense? I believe that the colour-sense should be considered the sixth sense. In nature there are not sudden breaks and sudden starts from evolutionary view point. There are the distinctly physical senses and there are the entirely psychic senses. So there should be a sense which lies between these two sets of senses. Colour-sense does this.

Nearly all of us perceive colours. Some can see more colours and others less in the range of the seven colours of the rainbow. By far the greater majority are not able to see indigo, though they can see both violet and blue. Some see less than six colours; so much so that some see only two colours. There are some who get mixed up between colours and that too to that extent, that they get puzzled between even red and green. Some can look at any binary colour like orange, green or violet and at once know intuitively that these are composed of red and yellow, yellow and blue, and blue and red. Some can even say the approximate percentages of each to make a certain shade of any of these binaries. Some can similarly tell components of compound colours of more than three components without ever having been taught. This shows that in this sense as in other physical and psychic senses there are degrees of abilities.

The most convincing fact is that there are people who can see objects around them but only in black, white and in shades of grey as we see in cinematographs. They see no colours. The fact that they see objects around them proves that they have the sense

of sight and the fact that they cannot perceive colours proves that they have not what we call colour-sense. Those who can see colours show that there must be a colour-sense and they have it as distinct from the sense of sight. Yet it is to a certain extent auxiliary to sight, for, perfect vision as we know it must see both form and colour. Those who see only forms even though quite clearly, yet show defective eyes. As a component part of perfect vision colour-sense is physical. Its psychic aspect is now to be shown.

In psychic abilities there are such possibilities as being in tune with some people and not with others, to be able to read thoughts of some but not of all and not always, see some spirits and not all spirits and not always. In physical senses if we can see one person we can see all; if we can hear the notes A and G then in that octave we can hear B, C, D, E and F also; if we can hear compliments we can hear abuse also. In psychic senses certain things can be done in the same range and not others, which we cannot explain easily. In colour-sense also it is like that. There are people who can see red and violet which form the two extremes of visible range of the octave and yet in the same octave they cannot see some colours like indigo or blue or red or green. If we can see triangles then we can also see squares, circle, etc; and if we can see a pyramid we can see cubes and spheres. This part is physical perception of form but the psychic part being colour perception it happens in ways we cannot fully explain, such as seeing two colours out of the range and not some colours between the two. We can understand that the whole gamut of colours infra-red and ultra-violet are not seen because they are outside of our perception, the same as notes of music as sung by mice is not heard by us and yet it is there and occasionally some psychic people hear it. I have heard some supernatural music which I

very much tried to analyse as either metallic, non-metallic or vocal and could not.

Then again it is known to most that there are parallel ranges of colours in psychic spheres and that we all, according to the nature of our thoughts, have colours round us which are visible to clairvoyant people. These colours are mysterious to us the same as other psychic phenomena. Some see spirits and others cannot and so are always mystified by the spirit phenomena.

In addition to these facts that show the colour-sense to be supernatural, I discovered one more fact that makes it somewhat mysterious. In 1918 while making my investigations in psychology I discovered that the congenital totally blind could also discriminate between colours. Thus colours do not exist as superficialities realisable with our eyes only but they exist independently of eyes. I put pieces of silk of same texture, handled equally, on ears of the totally blind and asked them to tell me the impressions these made. To my great surprise I found that all said that those pieces made different effects on them. If I gave a piece of red silk-cloth once and then gave green and asked if it was the same I got a very firm protest that it was not the same at all and if I gave green again and asked how different it was from the previous piece, I was told that I had not given a different one but the same one. They all could distinguish between different colours by means of their ears. One young man of say about seventeen offered to arrange them in the range of what he called their vibrations. I permitted him and to my great surprise I found that he had ranged them in the order of the spectrum. This may lead some people to say that it was a very acute sense of hearing. Yet my experiments showed that hearing could not explain away all cases. Several of these

interpreted their impressions in terms of warmth and cold. I tried to trip them. When one blind man said that red was warm I would give him green and ask him whether it was warmer and to my surprise was told that it was quite cool. Such answers made it doubtful whether it was a very acute sense of hearing that made them realise colours, for some of these said nothing about vibrations. We cannot bring this within tactile perception as the silks were of same texture and I had taken care not to handle any one piece more than the other so that no question of warmth of my hands or frictional electricity or magnetism can be raised. Thus neither acute hearing nor the sense of touch could explain. Then came another example which convinced me that the sense of colour was surely a psychic sense as well as a physical sense. When I put a piece of green silk on the ears of one congenital totally blind she said she felt as if she was in the country and fields. We may stretch our imagination that the piece of cloth touched her ear, and so that was tactile, yet we cannot say that when she is in the fields all the green blades of grass keep on touching her ears, etc. Even if they did that would not give the feeling of warmth from red flowers and cool feeling from green blades of grass. To tactile perception red petals of rose are as cool or warm as the leaves of its plant. Thus it is neither physical sight, hearing nor feeling that can explain away the realisation of colours, and so, we can safely call it a sense by itself which connects physical senses and psychic senses and therefore is truly the sixth sense. After this the senses that enable people to prognosticate may be called the seventh, eighth, and ninth sense or more, as, one by one it is shown which comes nearest to the sense of colour.

CHAPTER VII

COLOUR IN PUBLIC HEALTH AND OTHER USES

Colour surrounds us always. It is therefore wise to know the right uses of different kinds of colours. The country or nation that makes legislation for the right use of colour will lead the world in that direction and leave an immortal name in human history for thousands of years to come. Even the fact that the ancient city of Ecbatana gave seven different colours to the seven concentric walls that it once had, has left a great mark in the history of colours in its out-door use. We also know that the Ancient Iranian architecture is famous for the use of glazed coloured bricks.

All buildings must have an outside. Thus its condition and colour are important matters that should come in the sphere of public health. The outside of every building is a public property. It is the public on which the outside of a building makes an impression. Inside affects only a very limited number that stays in the building or uses it. The outside affects thousands daily. Legislation has been made in nearly all civilized parts of the world to ensure sufficient air, light and other sanitary requirements of the inhabitants inside buildings. Now that humanity is advancing all the time, legislation should also be made to compel house-owners to keep the outside in a pleasing condition. Often splendid buildings are constructed but for decades and decades the outsides are not renovated. In some towns in certain localities there are regulations for the outside upkeep of buildings. This should become general.

The modern type of architecture which sacrifices the beauty of form and architectural decorations to economy based on calculations of percentages to be earned on capital invested increases the desirability of use of colours in the outside of every building. As space cannot be used up in designs of forms the outside beautifying may be done by good colour schemes and colour designing. Whereas beauty obtained by design and symmetry of form is permanent, beauty obtained by colouring may not be permanent, unless done by use of such materials as can give such permanence. This is not impossible. It is not even difficult.

It is now fully a generation that some European countries achieved this object of bringing colour in beautifying the outside of buildings because of the economic demands on space. Belgium and Holland made many houses with glazed coloured tiles or bricks for their frontages. Some of such houses have remained neat till this day. Polished or glazed tiles and bricks used on the outside get automatically washed by rain and no annual or periodic coatings or colours are needed. In nearly all countries, particularly Hind, tile-making has progressed so much that as soon as a fashion is started to cover the outside of a building with coloured tiles, preferably glazed, it will spread all over. Municipalities may make it a rule to compel constructors of such buildings as are without architectural beauty of form to use colour in the outside and that it must be kept in good condition. These two regulations will at once bring in the use of such tiles. It should be understood that it is not necessary to cover entire walls with such tiles. If coloured cement is used, then only lines and curves around doors, windows, balconies, etc., can be permanently made to embellish the frontages by using glazed tiles. To produce the proper effect of colours besides mere embellishments it is desirable

to cover large areas of walls with colours, but that need not be made compulsory. Again exterior chromatics also should be controlled as some very offensive colour schemes can be made. Just as plans and front elevations of buildings are submitted for approval, so such colour-schemes for the frontages should also be first approved. In towns like Bombay, where one can rely upon rains to wash up the walls annually, use of coloured cements and coloured tiles or such glazed bricks which can be very advantageously obtained, would be ultimately economical as no periodic expense of painting or white-washing would be needed. Even in those towns where rains cannot be depended upon to do the washing every year or periodically, washing by human labour can be done which certainly cannot be so expensive as periodic painting.

Colourful beautifying of the exteriors of buildings has been done and can be done by more expensive materials also. In Italy many buildings have on the outside mosaic work, some with pictures in mosaic. These are permanent, but are more expensive; so it may not be possible for every country to undertake this sort of work. To decorate the outside walls with beautiful mosaic requires special skilled labour and all countries do not have this specialistic labour. Wealthy landlords with an ambition to beautify their towns or with religious devotion for making impressive exteriors of their places of worship can import such labour from taly. It is surprising that so many Hindvasi rulers have not adorned the exteriors of their palaces with heroic anecdotes in pictures of their ancestors.

Use of natural coloured stones is not so infrequent. All over Hind one sees excellent examples of such work, the best of the whole lot is the inlaid work on the exterior of the Taj Mahal which originally had precious coloured stones used for producing designs

and colour effect. Taj Mahal though best is not the only example as a great number of buildings of the Moghul period have left examples of inlaid exterior colour decorations which can in their own way rival those of mosaics of Italy. Calcutta has the most unique mosaic decorated building in the famous Jain temple. The exterior is adorned by glass mosaic of a kind entirely different from any to be seen anywhere else in the world.

One of the finest jewels of perfect architecture that almost miraculously has brought in it beauty of form, proportion and synthesis without the extreme use of symmetry is the Anjuman-i-Islam school near "The Times of India" office, in Hornby Road in Bombay, and though it is comparatively an old building it has not so aged in looks as its architect did not overlook the chromatic aspect. A very effective but very subdued colour scheme is to be seen in this building, which if preserved will for centuries bring credit to Hind for its beauty. The Bombay Municipal building is also worthy of notice. Another building which rivals this but which in moonlight can leave behind any structure except the Taj Mahal at Agra, is the Frere Hall at Karachi. This also had very impressive but subdued colour effect by the use of proper material, some of which of late is disappearing because of the renovating done by engineers who have no idea of esthetics, but its beauty of form and its excellent surroundings still make it a picture which once looked at, steadily gazed at and admiringly drunk in can never be forgotten. It is a matter of great satisfaction that the stupid adoption in Hind of the tendency of modern architecture in Europe of building large tenement barracks, as are to be seen in Bombay at the Back Bay Reclamation and the overwise idea of economic calculations have not affected those devoted minds that have built the new façade to Bai Pirojbai Vachha's Parsee Fire-Temple in Bombay.

The exterior of this is an example of the use of marbles and coloured stones to get picturesque effect without use of superficial paint. There is bound to be a great difference of opinion as to the degree of chromatic effectiveness, yet there can be none as a practical proof of the fact that permanent colour effect can be produced by the use of coloured stones of which this is the most striking example in Bombay or perhaps in all Hind in modern times. Very remarkable specimens of such exteriors are to be seen in Florence. It is to be hoped that Hindus and Muslims who claim greater religious devotion will start giving such coloured-stones' permanent façades of chromatic effects to their temples and mosques and thus add beauty to their towns. Such creations of art, architecture and beauty, cultivate the esthetic sense of the masses and they keep on doing so for hundreds of years. The Taj Mahal at Agra has been a school, a college, a university that has been training the esthetic sense of people of all the nationalities of the world in a way and to a degree that no other institution can claim to do. The millions spent and the labour used have not been in vain. Every esthetic creation, be it a palace, a painting or a well-dressed woman particularlly if in a saree develops the esthetic sense of those who look at them and is a source of joy and thereby becomes meritorious. Beauty that is not produced at the cost of moral or other well-being of mankind is an act of merit that can help the producer in attaining heaven by joy. Let landlords in building their structures try and earn merit for heaven besides interest on their capital. If they, of their own good sense do not do so, let the authorities compel them to do so. The exterior of a building is more the property of the public than of the landlord as it affects the people by thousands and not so much the family of the landlord.

As it is for the good of the public that the municipalities have to make some regulations, it is best to suggest a few ideas. Two colours, red and black, should not be permitted to be used to cover more than twenty-five per cent of the exposed area. This applies to pure reds like crimson and carmine that are not in any way toned down. Colours like maroon or terra-cotta which are toned down should be permitted over greater percentages of area according to the degree of toning up to even seventy-five per cent. The huge building of the " Prudential Insurance Co." in High Holborn, London, is a very striking example of hundred per cent terra-cotta. It can become a very imposing structure if 25% of its elevation can be covered up by black in lines, belts and small areas. Pure bright reds if used should not be permitted to be used in large areas, but distributed into small areas of lines, squares, or forms of different kinds. Small portions in red well distributed can have a very illuminating effect like that of lamps or lights. Large areas can be dazzling like kitsen lights. Any one wanting to use bright reds to a greater proportion than twenty-five per cent must also use areas of absolute black equivalent of the area additional to twenty-five per cent of red. Thus to use 35% of red at least 15% of black should be used. The remaining fifty per cent can be any colour or colours judiciously used. Next colour to be careful with is pink on which the same restraint should be put. Pure yellow should not be permitted to be used more than fifty per cent and bright red should be prohibited from being used along with yellow. These few precautions will be enough to prevent any atrociously offensive mixtures. If the person who has to pass the colour schemes the same as front elevations etc. have to be passed by the authorities wants to make sure that no colour scheme that he passes is offensive and if any particular one

looks so to him, he can modify it by asking that black from five to fifteen per cent should be added. Fifteen per cent may however be far too high for colour schemes based on blues or violets. Those towns that have not much foliage would be justified in insisting that at least twenty-five per cent of every exterior exposed to public view should be green. This would be the right thing for nearly all towns of Sind. Some may insist on more than twenty-five per cent of the exposed exterior area being green. Medium green being very helpful to eyesight it is an urgent matter of public health that in all such places where there is not much foliage and where there is much glare, green should be so used. Walls and other structures which surround areas set apart for sports such as stadiums, cricket grounds, etc., should be compelled to have green colour either by painting or by use of green cement or other building material, for the benefit of both players as well as the spectators.

There have to be regulations about the inside of certain buildings. All kinds of factories and works must have green walls and preferably sky-blue ceilings. From the ground upto four or five feet the walls should be white as in works and factories these portions of walls get dirty very soon and white shows the dirt the best. Thus they can be whitewashed frequently as they often get annoyingly dirty. Often machines and furniture, etc., cover walls up to that height, and so, not much benefit is derived by any kind of colour used up to that height. The effect of green walls and blue ceilings in factories and workshops is to bring to the nerves of the workers all such soothing effects as can be had by being in green fields and blue skies. In European countries where the sun is not so strong and is often rare, especially during winter, the use of orange ceilings is very strongly to be recommended. These simple considerations for the well-being of the workers

can make a very appreciable difference for the better, in the sum total of public health. If the health of workers is good the spread of such epidemics as influenza can be much checked. Just try and think of the effect of the vibrations made on them by green colour for eight hours of the day that the workers are in the factories or mills. The effect is not produced only during the time that they look at green walls but even at times when they are not conscious of being surrounded by green. From this rises the question whether the machines should also be painted green. It is possible to overdo a good thing and if a room of a factory or works is small and green then to paint machines green would be doing too much of a good thing. In such cases the machines may be made deep violet or heliotrope which is a colour particularly good for the nerves. In such big mills and factories where the halls are so large that workers do not come much near the walls, it is very likely that the vibrations of the colours get diffused a little and make very little effect on the workers. In such places the machines should also be painted green. The possibility of colour monotony due to distant green walls and green machines in a very large hall where very large numbers work, gets automatically broken by the clothes of the workers. The ceilings in the East may be blue or light grey and in Europe preferably orange to bring in the suggestion and effect of sun-light. We know that sun-light is white, etc., but orange in colour is best for that effect in cold countries as it combines the warmth of red and brightness of yellow.

The walls of schools, colleges and libraries, etc., also need serious attention of all true sanitarians. Taking into consideration all different aspects of the needs of the nerves and senses of children and students the best arrangement is a tall dado from ground that covers 40% of the wall area in heliotrope (55% blue

and 45% red of the same depth) and the remaining 60% of green (55% blue and 45% yellow of the same intensity) for the rest of the walls. The ceilings in warm climates should be either sky-blue or light-grey and in cold climates orange (30% red and 70% yellow of same intensity). For schools of children five per cent of each may be reduced and instead of that ten per cent of pure red or fifteen of subdued red may be distributed in pleasing figures or lines. In libraries where usually walls get covered by book-shelves etc. it should be so arranged that from every seat in the library a reader can rest his eyes upon a fair sized area of green and notices should be put up advising that after a steady reading of ten to fifteen minutes every wise reader should look at the green area for half a minute to a minute. When wall space is so badly needed that no such green areas easily sightable can be spared the best is to paint the ceilings green so that those who wish can just look up and gaze at the green expanse of the ceiling. As a rule the head is bent down for reading, and so, if for looking at the ceiling it is lifted up, that also gives additional relief to muscles.

The last place to be mentioned where the colours of the walls are to be judiciously chosen are hospitals and allied institutions. In hospitals cleanliness is *sine qua non*. Hence it may be even dangerous to compel use of colours if that can permit dirt even a day longer than white colour. Yet it happens that in some hospitals where the colour is white it is allowed to remain untouched longer than others where some slight other colour is used. Thus if one can be absolutely sure that colour will not be allowed to harbour dirt any longer than white colour, use of colours can be beneficial. First, we must consider those hospitals where one cannot be quite sure of the cleanliness if white is not used. In such places even if walls are white the ceilings can be coloured. As a rule most patients in hospitals pass a greater number of

hours in bed, and so, they can be more easily looking at the ceiling than the walls. Thus such benefit as can be derived by gazing at any colour can very well be got from coloured ceilings by patients lying on their backs. Generally in hospitals patients' nerves are not good. All sorts of colours cannot please all sorts of patients. Special attention should be given to patients specially suffering from nerves as they are more sensitive. Nerves are about the most easily healed by colours, of all ailments of mankind. Medium violets and greens are the most soothing colours for by far the very great majority of people suffering from nerves. Wall areas should be sixty per cent violet and forty per cent green. The ceiling can be blue or grey as the climate of the country demands. If walls have to be white then the ceiling can have a broad belt of green along the walls and rest of the ceiling violet. Red, orange and yellow should be studiously avoided, except in a ward or hospital for those suffering from some kind of morose mania, after making sure that the nerves are good, which is not very often the case. For insane people and those suffering from excitability red should be considered poison. It has been observed that quarrels and domestic unhappiness increase in a home with the increase of use of red colour. Some families' whole trend of unhappy lives have been changed by reducing red or altogether removing it. It is advisable that after patients become convalescent and are allowed to go out into the world to bear the usual strains, they are made to pass two or three hours in a yellow room to tone up the nerves. The suggestion to prohibit red and bright orange colours in hospitals is only for these as colours or paints, and not for lights or rays. Red, yellow and orange lights have their good specific uses the same as blue, green and violet but that subject is not within the scope of this chapter.

Public ornaments or objects like band-stands, benches, lamp-

posts, traffic stands, etc., can be very well painted red especially if they happen to be in green surroundings of gardens. As a rule these are small objects and red in small areas has a very pleasing and cheering effect. Sign posts and signal posts particularly for the use of traffic should be yellow. Red and yellow should never be used together unless it is somehow broken up by black.

Of the public buildings the interiors of dance-halls can be preponderatingly reddish or purple especially if there are gilt ornaments or decorations. Dance-halls or dining-halls should never be green or blue in preponderance. Theatres also should avoid the preponderance of blue or green.

Public buildings in the East, particularly Hind, like police courts, markets, etc., should have for four to five feet from the ground terra cotta painted on the outside, if they are likely to be visited by "pan-eating" public. All the covered foot paths, walls, pillars or arches by roadside of streets as in Hornby Road in Bombay must be painted terra cotta, for reasons that can be well appreciated by people living in those countries. This even if not less unhygienic is less disgusting.

It may be argued that if the effects of colours are so beneficial why not make regulations for use of colours inside private homes also as are made for light and air. The reason is that certain amount of freedom should be given to every citizen to please himself according to his tastes. Once the people's colour-sense is developed they will of their own accord make right kinds of colour schemes in their homes. Sitting rooms can have bright colours like orange or red nicely subdued. Bright colours of violet-purple range can be very suitable. The dining-room where perhaps the least time is spent can be having a preponderance of red, but preferably pinkish red is best. Blue is desirable for bed-rooms.

APPENDICES

Analytical Tables showing Colour Preference associated with Preference for Special Pursuits in Life

MALE—AGES

For boys under 13			Up to 13 years	14 years only	15 to 22 years	23 to 45 years	Upwards of 45	Remarks
Colours liked most	Motion and Adventure Per cent	Authoritative Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	
Red			7 Artistic	27 *	6 *	*	*	* When occupations are not mentioned but merely percentages then these apply to the corresponding occupations in the standard list. Occupations other than standard are mentioned alongside percentages.
			36 Engineering	18	23			
			9 Clerical	36	23			
			7 Playful	18	18			
			4 Gastronomic					
	31	3	0.7 Humane		23 Motion, etc.		1 case of Travelling at 57	
Blue			5 Arts	13	23	55	48	
			50 Engineering	13	23	11 Humane	Book-binding 1 case and Journalism	
			10 Clerical	40	26	11	1 case of 55	
			7 Playful	80 Motion	5 Playful	11 Politics		
			2 Gastronomic	3 Butcher	20 Motion	12 Bar-at-Law		
	26				1 case of Artistic		Artistic	
Yellow			9 Artistic	1 case only of	1 case of		1 case of 54	
			30 Engineering	Engineering	Motion and			
			Clerical		one of no			
			40 Playful		choice			
	26	4	26 Labour		(1 case)			
Green			10 Artistic	10	4 Lawyer	42 Artistic		
			51 Engineering	10 Motion	24 Engineering	14 Teaching		
			9 Clerical	80 Clerical	48 Clerical	14 Entertaining girls		
			2 Hairdresser		16 Motion	14 Dancing		
	20	2	4 Labour		8 Playful	14 Humane		
Violet			15 Artistic	22 Artistic	15 Artistic	1 case of 80	1 case of 50	
			88 Engineering	22 Engineering	15 Engineering	Finance	Painting	
			12 Playful	33 Motion	30 Motion			
			30 Gastronomic	22 Farming	15 Intellectual			
			8 Humane		15 Playful			
	80				10 Husbands			

Analytical Tables showing Colour Preference associated with Preference for Special Pursuits in Life

MALE—AGES

Boys under 13 years			Up to 13 years	14 years only	15 to 22 years	23 to 45 years	Upwards of 45	
Colours liked most	Motion and Adventure Per cent	Authoritative Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Remarks
Pink	27	5	5 Artistic 45 Engineering 11 Clerical 5 Playful 2 Gastronomic Humane	50 Artistic 50 Clerical There were only four returns two each	29 * 29 29 13 Motion			
Black	40		20 Engineering 20 Playful 20 Chimney sweep	50 (1 Case for Merchantile 50 Marine and one for Farmer)				
White	40		10 Arts 25 Engineering 5 Clerical 20 Labour	One for travelling	33 One for Architecture Another for nothing, Age 19 33 One for Motion			
Grey	33		55 Engineering 11 Gastronomic	66 Artistic (2 cases) 33 Clerical (1 case)	50 2 cases Engineering 50 Clerical (2 cases)			
Brown	80		80 Arts 40 Engineering	33 Arts (1 case) 33 Clerical (1 case) 33 Motion (1 case)	Arts (1 case)	33 Arts 33 Playful 33 Engineering		* See note under "Remarks" on p. 165.

Analytical Tables showing Colour Preference associated with Preference for Special Pursuits in Life

FEMALE—AGES

Under 11 years		Upto 11 years	12 year old	18—21 years	23—45 years	Upwards of 45	
Colours liked most	Those who like motion or movement Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Remarks
Red		30 Arts 2 Authoritive 11 Clerical 2 Playful 18 Humane 5 Domestic 30 Do not know	30 * 10 20 30 10 Farming	16 Arts 37 Clerical 37 Playful 10 Domestic	*		
Blue		26 Arts 15 Authoritive 6 Clerical 12 Playful 13 Humane 8 Domestic	42 5 5 28 23 19	34 20 Authoritive 25 Clerical 30 10 5	34 3 Motion 22 3	37 Arts 37 Authoritive 12 Domestic	
	4	15 Do not know		10		12 Dreaming	
Yellow		Arts 17 Authoritive 17 Riches 8.0 Playful 33 Humane		12 Arts 68 Clerical 12 Motion 12 Humane	20 Social 60 20 Authoritive Organizing	One surgeon of 57 prefers medical work; another woman likes social and literary	
	17	8.0 Domestic					
Green		28 Arts 7 Authoritive 21 Clerical 21 Playful 7 Humane 4 Domestic 4 Do not know	33 Arts 22 11 22 11	42 2 18 22 2 5 1	57 43	One case of 46 years for Secretarial work	
Violet		28 Arts 40 Humane 9 Authoritive 6 Clerical 3 Playful 3 Domestic	33 Arts 33 Clerical 34 Humane	25 Arts 1 Clerical 34 Playful 29 Domestic 5 Motion	20 Arts 20 Authoritive 20 Humane Motion 20 Exploring 20 Domestic	One case of 68 likes Journalism	
	6	3 Do not know		5 Do not know			

* See note under "Remarks" on p. 165.

In some returns people do not say what they like to do the best. At times working out statistics in percentages one gets vulgar fractions which have to be dropped. Thus the totals of percentages of occupations do not always sum up to one hundred as we cannot mention a half or one-third person.

Analytical Tables showing Colour Preference associated with Preference for Special Pursuits in Life

FEMALE—AGES

Under 11 years		Upto 11 years	12 year old	13—21 years	22—45 years	Upwards of 45	
Colours liked most	Those who like motion or movement Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Profession chosen Per cent	Remarks
Pink		20 Arts 13 Authoritive 10 Clerical 10 Playful 16 Humane 2 Gastronomic 28 Do not know	75 * 4 25 17 4 17 17	36 * 10 19 33 2.0 7 Domestic 1	50 Arts 2 cases 25 Clerical 1 case 25 Travelling 1 case		One girl of twenty likes talking the best. She has stupid handwriting.
Black			One child of 12 likes black and chooses Reading as best occupation				One child of ten wants to become a spiritualistic medium.
White		12 Artistic 24 Authoritive 12 Clerical 30 Do not know 6 Playful 6 Domestic	1 case each 25 ,, 25 ,, 25 ,, 25 ,,	75 Artistic 3 cases 25 Playful (1 case)			Percentages work out very high when returns are very few. Those who like white at the age of 13 to 21 have three out of four for artistic occupation and thus get 75 per cent for artistic.
Grey	6	6 Humane		75 Artistic (3 cases)	Artistic age 25 1 case		* See note under "Remarks" on p. 165.
Brown		Less than 10 25 years Artistic (1 case) 25 Authoritive (1 case) 25 Clerical 1 case 25 Domestic (1 case)	66 Arts (2 cases) 33 Domestic (1 case)	25 Clerical (1 case) 23 Arts 7 15 23	30 Artistic 4 cases 20 Humane 1 case		
Shining Brown	15			15 Playful 1 case of old gold: Clerical 1 case of golden brown Nursing	One case of 19 for copper colour chose Music		
Old gold etc.							